Acrylic base plate

The material most often used for base plate is cold cure or heat cure acrylic. It forms a major part of the removable appliance. Base plate acts as a support for pressure sources and distributes the reaction of these forces to the anchorage areas. In the maxillary arch it should extend to the distal of the first molar and slightly cut off in the midline, while in the lower arch does not extend too deep to avoid trauma to the sulcus and any undercut area should be blocked.

Properties of base plate
1. It incorporates both the retentive and active components into a single functional unit (act as major connector).
2. It helps in anchorage and retention of the appliance in the mouth by contact with the palate and with teeth intended not to move and distributes the forces from the active components over a large area.
3. It protects the palatal springs against distortion in the mouth.
4. Bite planes can be incorporated into the base plate and used to treat specific problems.
5. The baseplate should be as thin as possible to reduce bulk yet thick enough for strength. It should be closely adapted to all teeth except those which are to be moved.

Modifications of acrylic base plate

Bite plane (anterior or posterior) can be added to acrylic base plate
1. Flat anterior bite plane (FABP):
   Action: the anterior bite plane is added to the maxillary plate to prevent the posterior teeth from occluding by contacting with lower incisors opening the bite posteriorly.
   Properties: the bite plane should be wide enough that the patient cannot bite behind it. It should be flat, not inclined posteriorly, to avoid mandibular retrusion effect. This is particularly important in class II malocclusion.
   Indication: it corrects deep bite by separating the molars allowing them to over-erupt & so decreasing the overbite. After opening the bite, the bite plane is cut lingually but not occlusally to allow for upper incisor retraction.
2. Inclined anterior bite plane:
It also corrects deep bite, added to the maxillary plate, but it corrects increased overjet as well by proclining lower incisors and acting as a myofunctional appliance enhancing mandibular growth & retarding maxillary growth.

3. Posterior bite plane:
Action: the posterior bite plane can be added to the maxillary or mandibular plate. It usually covers the occlusal surfaces of all the posterior teeth, so that when the teeth are brought together the mandibular canines, premolars & molars occlude on the bite plane, thus leaving the incisors out of contact & free to be moved without occlusal interferences.
Indications:
- It opens the bite anteriorly to allow, correction of anterior crossbite.
- Treatment of posterior crossbite by expansion screw. The bite plane is flat on both sides to allow for mandibular repositioning after crossbite correction.

Anchorage components:
It is an imaginary component of the removable appliance resisting unwanted tooth movement. In orthodontic treatment we apply force to move the teeth, and according to Newton’s third law (for every action there is a reaction of equal magnitude and opposite direction), so this means that when we apply a force to move the teeth, the reaction force will be transmitted through the appliance and tends to move the anchor teeth in the opposite direction which is undesirable and should be avoided.
Classification of anchorage: According to the

A- Way of applying force:
1- Simple anchorage (resistance to tip) the anchor unit's resistance to the tip is used to move other teeth. Simple anchorage is an anchorage that uses teeth that have greater resistance as anchors to move teeth that have smaller resistance. It is used in removable appliance.
2- *Stationary* anchorage (resistance to bodily movements) means the anchor teeth do not move at all, cannot be used in removable appliance.

3- *Reciprocal* anchorage involves using two teeth or two groups of teeth that have the same anchor value to each other to produce reciprocal tooth movements for example: diastema closure, transverse expansion.

B- **The jaws involved**

1- *intraaxillary*: anchorage is established in the same jaw.
2- *interaxillary*: anchorage is distributed to both jaws.

C- **Anchorage location**

1) *intraoral*: anchorage is obtained inside the mouth
2) *extraoral*: anchorage is obtained outside the mouth, for example a) cervix: e.g. neck strap, b) occipital: e.g. head, c) cranial: e.g. high pull headgear, and d) facials: e.g. face mask; and 3) muscular: anchorage comes from muscle action.

D- **Number of anchorage units**

1) *single* or primary anchorage: anchorage only involves one tooth, 2) *compound* anchorage: anchorage involving two or more teeth, and 3) *reinforced* anchorage: adding a non-dental anchor location. For example, mucosa, muscles, head, etc.
Factors that affect anchorage

1- **The root surface area** the tooth root surface area in the anchor group should be larger than the teeth to be moved so that the movement of anchor teeth is as minimal as possible. This can be performed by only moving one tooth each quadrant and involving as many anchor teeth as possible.

2- if the **force** is too large, the anchor teeth will also move, so keep the force as low as possible.

3- **Tendency of the teeth to shift to mesial.** Therefore, it must be carefully considered if there is a mesial force acting on the anchor teeth. For example, in canine retraction there is an action to move the canine distally and there is a mesial force or retraction acting on the anchor teeth.

**Anchorage management:**

1- keep the force used light enough to move the wanted teeth without affecting the anchor teeth.

2- increase anchoring resistance:
   a- increase the number of teeth in anchor unit (e.g., second molar)
   b- reduce the number of teeth to be moved
   c- teeth with large root surface area have greater anchorage value than teeth with small root surface area.
   d- base plate: covering teeth and mucosa
   e cuspal interlock with the teeth of opposing arch example: anterior and posterior bite planes with good occlusal contact with the cusps of the teeth of opposing arch.
   f- reinforce the anchorage: Various other ways include, the use of palatal arch, Nance arch, lingual arch, lip bumper, extraoral device.
   g- Distribution of the retentive units: Tammoscheit (1969) described three types of anchorage systems based on geometric designs for the placement of the retentive units to obtain the best anchorage value.
Fabrication of a removable orthodontic appliance

The materials used in removable orthodontic appliance are:

a- Stainless steel wires (springs, clasps and labial bow).

b- Acrylic base plate (hot cure acrylic, cold cure acrylic or most commonly orthocryl).

The steps are:

1. Do the necessary wire bending (springs, labial bow and clasps).

2. Fix the springs and clasps to the cast by wax on the occlusal and labial surfaces of the teeth, so that they do not move during fabrication of the acrylic. Wax is applied on the coils and arms of Z-, recurved, T- and finger springs not to be embedded in the acrylic baseplate.

3. Soak the cast in water for about 5 minutes until no more air bubbles come out of the cast to prevent the monomer from entering inside the cast and fusing the acrylic with the stone of the cast.

4. Materials: either heat cure or cold cure acrylic which is preferred because it is easy to use and faster to fabricate but care must be taken to eliminate residual monomer to reduce the porosity in the appliance, so orthocryl (a type of cold cure acrylic that need to set under pressure in a hydroflask) was introduced and gave better properties, it can be prepared by the dough stage method or by the sprinkle method (salt and pepper) to construct the acrylic base-plate by successively applying polymer and then monomer.

5. Cure in a hydroflask under 2 bar pressure to eliminate porosity. The hydroflask contains water at 40°C to accelerate the curing reaction.

6. The wax is cleaned and the acrylic base plate is finished with a carbide bur and polished with pumice.

Welding:

Welding is the union of two stainless steel wires by melting them onto each other by passing an electrical current through them. This is accomplished by a welder machine.

The two wires are put in firm contact under pressure of the jaws of the welder and then a low voltage high amperage electrical current is passed through the wires to melt the surfaces of the wires and make them fuse.

The resulting welding joints are generally weak and require soldering for reinforcement but can be used for fixation prior to soldering.
Note: the wires should be welded at right angle to each other (not parallel) to have a small contact surface area that concentrates the electrical current and make the wire melt more making a stronger joint.

Soldering:
Soldering is the union of two stainless steel parts by a third material (solder). The requirements are:
1. A butane gas fine flamed torch.
2. Silver solder wires (low melting type, in the shape of wires 0.5-0.6mm in diameter).
3. Flux either separately or incorporated in the solder wire.

Welding and soldering is generally used in orthodontics to:
1. Repair fractured clasps.
2. Solder Hawley arch or buccal canine retractor to the bridge of the Adams clasp.
3. Solder a variety of modifications to the bridge of the Adams clasp (e.g. hooks for elastics and face bow tubes).

Fitting a removable appliance for the first time
An appliance should be ideally fitted as soon as possible after the impression has been taken and any delay in fitting an appliance allows forward movement of posterior teeth following
orthodontic extraction or natural loss of deciduous molars and may interfere with fitting the appliance.

Fitting the appliance

a) Before inserting the appliance

1. Check that you have the correct appliance and design for the patient.
2. Show the appliance to the patient and explain how it works.
3. Check the fitting surface for any roughness

b) Inserting the appliance

1. The appliance should be inserted into the mouth with the anterior part lightly into position and then press the acrylic base upwards until the molar clasps engage. Removal of the appliance: Should be carried out in the reverse order. The finger tips are used to pull down on the bridges of the molar clasps until they disengage readily, make sure the patient can insert and remove the appliance.

2. Adjust the retentive components and check the retention.
3. Activate the springs and check the teeth if they are free to move (adjustment of retention comp., so that the appliance will be retention inside mouth).

c) Instruction to the patient and to the parents:

1- The patient should be shown in a mirror the insertion and removal of the appliance. Insist that the appliance be maneuvered by the bridges of the clasp and not the labial bow or springs. The correct method of insertion is to engage the anterior wire on the incisors and then press the acrylic palate upwards until the molar clasps engage. Removal is accomplished by pulling down on the molar clasps before disengaging the anterior teeth

2- You might face some discomfort during eating and speech in the first few days and in case of appliance damage report immediately to the dentist.
3- You should wear the appliance during day and night (24 hrs).
4- You should clean your teeth and the appliance regularly without distorting any component.
5- Avoid all sticky or hard foods such as; boiled sweets, chewing gum etc. These precautions will minimize the chances of a breakage
Monitoring progress during visits

At each visit:

- Check for wearing of the appliance: by noticing the following: 1. There is little or no tooth movement. 2. The appliance still looking new. 3. The patient has difficulty in removing and more importantly in inserting the appliance. 4. Springs are still active and patient speech still affected (while wearing the appliance).
- Reassess the treatment plan aims.
- Record the molar relationship, overjet and overbite.
- Check the active and retentive components. Check that the patient is not using them to remove the appliance or putting it in his pocket during meals causing distortion.
- Anchorage situation.
- Whether the bite-plane or buccal capping need to be increased and/or adjusted.
- Record what action needs to be undertaken at the next visit.

Common problems during treatment

1. Slow rate of tooth movement:
   Normally tooth movement should proceed at approximately 1 mm per month in children, and slightly less in adults. If progress is slow, check the following:
   - Is the patient wearing the appliance full-time?
   - Are the springs correctly positioned?
   - Are the springs underactive, overactive, or distorted?
   - Is tooth movement obstructed by the acrylic or wires of the appliance?
   - Is tooth movement prevented by occlusion with the opposing arch? It may be necessary to increase the bite-plane or buccal capping to free the occlusion.

2. Frequent breakage of the appliance
   - The appliance is not being worn full time.
   - The patient has a habit of clicking the appliance in and out.
   - The patient is eating inappropriate food while wearing the appliance.

3. Excessive tilting of tooth being moved
   - The further that the spring is from the center of resistance of the tooth the greater is the degree of tilting. Therefore, a spring should be adjusted so that it is as near the gingival margin as possible without causing gingival trauma.
   - Excessive force is being applied to the tooth.

4. Lack of overbite reduction
In children, the most common reason for lack of progress with overbite reduction is that the appliance is not being worn during meals. Patients should be advised that their treatment will be quicker and more successful if they wear their appliance for eating, and that adaptation will be enhanced if they start with softer foods.

5. Palatal inflammation
This can occur for two reasons:
- Poor oral hygiene.
- Entrapment of the gingivae between the acrylic and the tooth/teeth being moved.
- Trauma from active arm of the spring.

6. Anchorage loss
This can be increased by the following:
- Part-time appliance wear, thus allowing the anchor teeth to drift forwards.
- Over activation; the forces being applied by the active elements exceed the anchorage resistance of the appliance.

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**Appliance repair**

Before arranging for a removable appliance to be repaired the following should be considered:

1- How was the appliance broken? If a breakage has been caused by the patient failing to follow instructions, it is important to be sure any co-operation problems have been overcome before proceeding with the repair.

2- Would it be more cost-effective to make a new appliance?

Occasionally it is possible to adapt what remains of the spring or another component of the appliance to continue the desired movement.

3- Is the working model available, or is an up-to-date impression required to facilitate the repair.

4- How will the tooth movements which have been achieved be retained while the repair is being carried out? Often there is no alternative but to try and carry out the repair in the shortest possible time information and instruction for the patient after insertion the appliance is meant to be worn at all times - 24 hours a day- the appliance should remain in the mouth throughout usual activities such as; eating, sleeping, playing sports etc. It is only to be removed when cleaning the teeth.
Repairing a fractured Adam's clasp:

The Adam's clasp is commonly fractured from the U-loop because it has an acute bend. The procedure of soldering is as follows:

1. Flux is added on the wire to prevent its oxidation under the flame.
2. Direct flame is used to heat the wires until they become red. Care must be taken not to overheat the neighboring acrylic.
3. Silver solder is added to unite the two fractured parts.
4. The soldering joint is immediately quenched in water to give the solder hardness.
5. Excess solder is removed by a bur and the joint is polished.

Acrylic repair

1. Make all active comp. passive
2. Reduce retention
3. Put it inside the mouth
4. Take and impression
5. Send to lab
6. Re-inserted again