

Treatment Technique: Practical & Clinical Management of Angle Class III Malocclusion

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ABSTRACT

This article is a continuation of the series of technique training in orthodontics especially for the post-graduate trainees as well as for the practitioners who will learn and practice Fixed Appliance Technique. Once again, I believe that post-graduate trainee doctors, faculty members, private practitioners and all other concerned will find this article as a guide line during their training as well as in their professional practicing period.

The article describes the technique training and design of standard edge-wise-technique in sequential stages with illustrated case reports for treating class III molar relationship with crowded arch in maxilla and anterior cross bite. The author acknowledges that the article is summarized from the lectures, hand-outs during his postgraduate studies in Kyushu University and Hiroshima University, Japan. (Ban J Orthod & Dentofac Orthop, April 2011; Vol-1, No. 2, 29-36)

INTRODUCTION

There are many definitions of Class III malocclusions and most common is "an occlusion in which the buccal groove of the mandibular first permanent molars occludes mesially at least more than half a cusp to the mesiobuccal cusp of maxillary permanent first molar". A class III malocclusion may also be termed as an anterior cross bite relationships.

Treatment options in growing children with anterior cross bite with crowded arch in maxilla are^{1,2,3,4,5} :

1. Appliances to restrain growth of mandible : Chin cup
2. Appliances primarily directed for orthopedic effect on maxilla: reverse pull headgear
3. Appliances which affect both jaws by growth modification with Class III Activators. However, final detailing of the orthodontic treatment is undertaken with the fixed appliance with the objective to give a normal over jet (Illustrated Case 1, Case 2, two stage technique).
4. Crowding in the arches due to tooth size and arch size discrepancies may necessitate extractions in one or both the arches followed by the fixed appliance technique.

In this article the technique and training for the treatment progression of Class III molar relationship with crowded arch in maxilla with anterior cross bite is described in EXTRACTION CASE (Upper 2nd premolars & lower 1st premolar extraction):

SEQUENTIAL STAGES

STAGE 1. Distal movement of the mandibular molars (for the correction of the Class III molar relationship) and reinforcement of anchorage.

STAGE 2. Leveling (1).

STAGE 3. Leveling (2).

STAGE 4. Mandibular canine retraction and mesial movement of maxillary molars.

STAGE 5. Leveling after mandibular canine retraction.

STAGE 6. Mesial movement of the maxillary molars and lingual movement of the mandibular incisors.

STAGE 7. (1). Establishment of Occlusion (Ideal arch).

STAGE 7.(2). Alignment of maxillary second molars.

STAGE 8. Removal of the brackets and bands for Retention.

STAGE 1. Distal movement of the mandibular molars (for the correction of the Class III molar relationship and reinforcement of anchorage)

Mandible: - Adjustment of the mandibular cervical Head Gear.

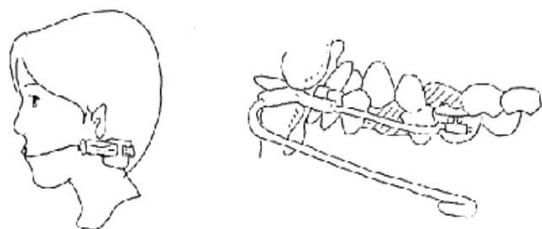
Objective

Distal movement of mandibular first molars for the correction of Class III molar relationship or to reinforce the anchorage against the retraction of mandibular canines and incisors.

Design

1. The anterior part of the inner-bow is placed 7-8 mm in front of the mandibular incisors.
2. The fitness of the inner-bow is checked; when each end of the inner-bow is inserted to the molar tube passively when there is normal molar width without any rotations.
3. When both ends of the inner bow is inserted into the buccal tubes, the front part of the inner bow should be placed just between the upper and lower lips. To do this, the inner bow might be bent to get a curve along the mandibular curve of Spee.
4. Traction force should be applied at about 300-400gm level on each side.

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Design: 1

Purpose of extra oral anchorage

The mandibular first molars are moved by the traction force delivered from the mandibular extra oral anchorage appliance (face bow and neck band cum cervical Head Gear.) In the case that the mandibular first molars are in bucco or linguo or torsioversion, the malposition of the mandibular first molars have to be corrected by the lingual arch before the extra oral anchorage appliance is adjusted.

The extra oral anchorage appliance should be worn at least 14 hours a day. If the patient cannot wear the appliance enough, the Class III inter maxillary elastics should be worn during the day-time.

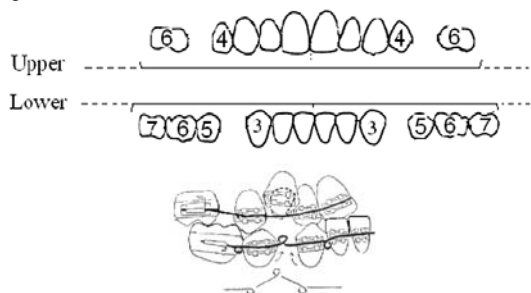
In the case that the extent of skeletal Class III relationship and Class III molar relationship are not so severe that the Class III molar relationship can be corrected by the mesial movement of the maxillary first molars, the Class III elastics without the mandibular extra oral appliance will be effective.

STAGE 2: Leveling may be done in several subsequent visits according to the degree of malocclusion.

LEVELING (1)

Maxilla: .014, .016 inch Nitinol wire or similar size S.S. wire
Mandible: .014, .016 inch Nitinol wire or similar size S.S. wire
While using S.S. wire, multiloop arch wire should be prepared according to individual variation of malocclusion.
Objective: Leveling of maxillary and mandibular dental arches.

Design:



1. The off-set bend in the upper and lower first molars and the toe-in bend in the lower second molars are incorporated into the arch wire. The length of the arch wire is 2-3 mm long, just out of the terminal buccal tubes.
2. The distal end of the arch wire is heated (2-3 mm) and bent (cinch back) to avoid the slipping out of the arch wire after placement to avoid trauma.
3. When the bracket of mandibular molars is placed cervically on the crown surface because of the occlusal contact, second order bend is incorporated into the arch wire.

Ligation

1. Single tie
The arch wire is ligated to the teeth loosely so that the teeth can move along the arch wire.
When the malposition of each tooth is so severe that the arch wire cannot be placed into the slot safely, the arch wire is ligated loosely so as to not either deliver a strong force on the teeth or not to distorted permanently.
2. Cinch back
The distal end of the arch wire is bent to avoid the slipping out of the arch wire after placement.

Check Point

When the malposition of each tooth is almost corrected and the .016 inch round arch wire in STAGE 3 can be placed, the next STAGE is recommended.

Objective of leveling

The objective of leveling is the alignment of all teeth to make it possible for the arch wire in STAGE 3 to be placed. So, if the .016 inch round arch wire in STAGE 3 to be placed easily, STAGE 2 can be skipped. Only when .016 inch round arch wire in STAGE 3 cannot be place because of severe malposition of the teeth, STAGE 2 is necessary.

In the beginning of leveling, highly resilient wire is ordinarily used. Ni-Ti alloy wire (Nitinol, Titanal, Sentalloy etc.) is popular because they are very flexible, are hard enough to avoid permanent deformation and the fabrication of the arch wire is not necessary, and they deliver light and continuous force for tooth movement. But on the contrary, the handling of that wire needs great care, because the fabrication of it is extremely difficult (it might be broken when the bending force is too strong) and when some bracket level is located too gingivally because of occlusal relationship, the second order bend is inevitable while using SS wire.

Basically, Upper and Lower arch wires are made IDEAL in form (the width of the arch wire is the same with the width of original dental arch) and coordinated to each other from the beginning of the treatment. But it is difficult to fabricate the above mentioned Niti wires, as they are supplied in the form of ready-made contoured arch. Thus, beginners are discouraged to use ready-made contoured arch wire.

When the anterior crowding is so severe that the flaring of anterior teeth seems to be inevitable, the ligation of severe malposed teeth should be postponed until enough space for alignment is regained by canine retraction, or the canine retraction is achieved with the sectional arch wire.

STAGE 2 takes about 1-3 adjustment before STAGE 3.

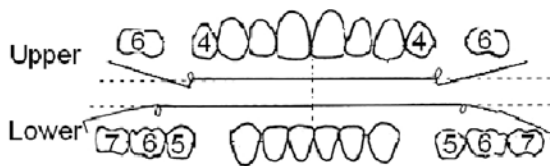
When the arch wire cannot be inserted into the slot because of malposition of the teeth, it is ligated loosely. And after 4 weeks (next visit), the ligation is tightened as the teeth move and have made it easy for the insertion of the arch wire into the bracket slot. If the leveling cannot be accomplished, instead of these adjustments, .016 inch round arch wire can be replaced by .018 inch round arch wire.

STAGE 3 Leveling (2)

Maxilla: .016 inch round wire
Mandible: .016 inch round wire

Objective: Leveling in high degrees.

Design: Diagrammatic



1. Maxilla: IN SET BENDS in the lateral incisors and OFF SET BENDS in the canines and the first molars are incorporated into the arch wire. OFF-SET BENDS in the first molars are placed 4-5 mm mesial to the molar tubes.

2. Mandible: OFF SET BENDS in the canines and the first molars and TOE-IN BENDS in the second molars are incorporated into the arch wire.

3. The arch wire is flat mesial to the first molars.

4. STOP LOOPS

Maxilla: 1 mm distal to the second premolar brackets.

Mandible: 1 mm mesial to the first molar brackets to prevent forward movement of the incisors when ligated.

5. DISTAL TIP-BACK BENDS are incorporated into the arch wire to prevent mesial tipping of posterior teeth:

Maxilla: 20 degrees in the first molars.

Mandible: 10 degrees in the first molars and 10 more degrees in the second molars.

6. HEAT TREATED to GOLDEN WHEAT / FOX BROWN COLOR.

Ligation

1. Single tie: The arch wire is ligated tightly from this STAGE. If there still exists some malposition of the teeth that makes the ligation difficult, use the elastics instead of ligature wire. At the end of this STAGE, the arch wire should be fully engaged into the slot and finish the leveling.
2. Mandible: the distal end of the arch wire is bent (cinch back).
3. Tie back: none.

Observations

At this STAGE, the dental arch form is almost straightened in bucco labial view. If the bracket position (height and/ or angulations) is recognized to be wrong, it is suggested to change the bracket position immediately.

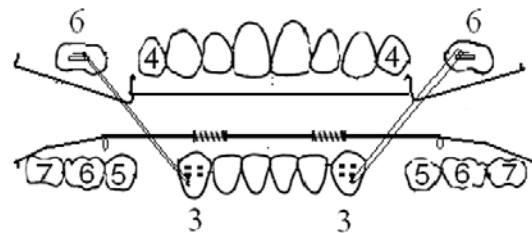
STAGE 4 Distal movement of mandibular canines (and mesial movement of maxillary molars.)

Maxilla: .016 round wire ~ .016 X.022 inch rect. (depending on the case).

Mandible: .016 round wire wire ~ .016 X.022 inch rect. (depending on the case).

Objective

1. Distal movement of the mandibular canines.
2. Mesial movement of the maxillary molars.
3. Leveling.
4. Correction of midline shifting



1. Maxilla: The wire size is selected depending on the case

- Ideal arch form with OFF-SET BENDS in the first molars are placed distal to the first premolar brackets to prevent the mesial movement of molars.
- TIP BACK BENDS are incorporated: 20 degrees in the first molars.
- THIRD ORDER BENDS may be incorporated.
- HOOKS made of .025 inch brass wire are soldered to the GINGIVAL surface of the arch wire on the OFF-SET BENDS between the first molar and premolar for tie-back.
- HOOKS made of .025 inch brass wire are soldered to the GINGIVAL surface of the arch wire at the contact areas between the lateral incisors and the canines for elastics, if necessary.

2. **Mandible:** Same arch wire as STAGE 3 except bent-in stop loops attached to the mandibular first molar tubes.
3. HEAT TREATED to GOLDEN WHEAT COLOR.
4. The distal end of arch wire is heated (2mm).
5. The mandibular canine retraction is started by incorporating the open coil spring in the arch wire between the lateral incisor and the canine. The force delivered from the coil spring is 150 gm.
6. After the maxillary .016 X.022 inch arch wire is placed, the Class III elastics is placed for the mesial movement of maxillary molars and lingual movement of the mandibular incisors.
7. When the mandibular midline is deviated, the strength of the coil spring is changed on one side to correct the midline shifting.

Ligation

1. FIGURE EIGHT TIE

Before the arch wire is placed into the slot, the brackets on the maxillary front segment (4~4) and the mandibular lateral segment (5~7) are directly ligated by .009 inch ligature wire in figure eight.



2. The canines should not be ligated too tight to enable slide on the arch wire for retraction.
3. When the Class III elastics are placed, the mandibular canines are tied with TIE-HOOK.
4. After ligation, the arch wire is checked to see whether the distal movement of the canines is possible or not.
5. TIE-BACK (U/L), CINCH BACK (U/L):

Maxilla: When the arch wire is rather light, the wire is tied back lightly. But when the .016 X.022 inch wire is placed, the wire is tied back with elastics to accelerate the mesial movement of the maxillary first molars.

Mandible: The mesial migration of the arch wire caused by the coil springs is prevented with tie-back and cinch back distal to the molars.

Check point

1. The progress of mandibular canine retraction and mesial movement of maxillary first molars.
2. The lost or looseness of ligature wire.
3. The lost or looseness of tie-back ligature wire.
4. The activeness of coil spring.
5. When the space is closed unilaterally or midline is deviated, the coil spring is used unilaterally or the strength of coil springs is differentiated)

Comment

Mandibular canines are retracted by compressing the open coil between the lateral incisors and canines and class III elastics. Mandibular teeth except canines and maxillary teeth work as

anchor by tying back the arch wire. Anchorage is reinforced by cervical Head Gear, TIP-BACK BEND and class III elastics. If the anchorage is insufficient, the reaction of canine may cause mesial movement of the mandibular dental arch and makes the Class III dental arch relationship worse.

The Class III elastics should not be placed when the maxillary arch wire is not hard enough, because the maxillary molars might be subjected to expansion, rotation and elongation by the elastic force. The anterior teeth are flared labially if the tie back ligature wire is loosened and the distal end of the wire is bent (Tip back) When the elastic chain or elastic thread is used, the first and second molars are ligated in figure eight and the elastic chain (or tie) is placed between the canines and the second molars.

To prevent the space opening and flaring of the anterior segment during canine retraction, four incisors are ligated in figure eight. If the force is too strong, the wire between the canines and the second premolars are bent and cause the rotation of the teeth.

Canine retraction is continued until the canine relationship becomes Class I

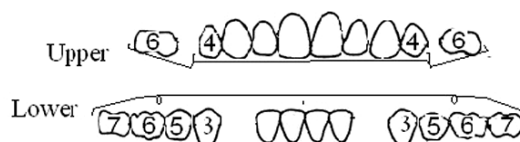
STAGE 5 Leveling after mandibular canine retraction.

Maxilla:.016 X.022 inch rectangular wire (same with STAGE 4)
Mandible: .016 X.018 inch, .016 X .016 inch rect. wire

Objective

1. Leveling after mandibular canine retraction.
2. Leveling in high degree
3. Correction of midline deviation.

Design



1. **Maxilla:**The same arch wire in STAGE, and continue the mesial movement of the molars.
2. **Mandible:**
 - The BENT-IN, TIE BACK, STOP LOOPS are placed FLASH with the mesial of the first molar brackets to prevent the mesial movement of the molars.
 - The arch wire is made IDEAL in form.
 - The arch wire is flat mesial to the first molars.
 - The arch wire has SECOND ORDER BEND with TIP-BACK BENDS (first molar 10 degree, second molar 20 degree)
 - TORQUE: passive
 - HEAT TREATED to GOLDEN WHEAT COLOR.

- INTERMAXILLARY CLASS III ELASTICS are worn for mesial movement of maxillary molars and lingual movement of mandibular incisors.
- When the midline is shifted, the open coil is used unilaterally.

Ligature

- FIGURE EIGHT TIE
before arch wire is placed 4-4 for upper arch, 2-2, 3-7 for lower arch
- SINGLE TIE
Tightly especially mandibular canines.
(When rotated after retraction.)
- TIE BACK and CINCH BACK (U/L):passive.

Check point

- Whether the correction of midline deviation is corrected.
- Whether the leveling of the teeth is sufficient or not.

Observations & Necessary Measures

On the way of canine retraction, the canines tend to tip and rotate distally and the curve of Spee might not be flattened thoroughly.

To engage the next .016 X.022 inch arch wire (STAGE 6), it is necessary to level the dental sufficiently till the end of STAGE 5. If the leveling is incomplete, the next .016 X.022 inch arch wire may deliver a heavy force so much that it causes tooth pain and the correction of rotation of canine becomes difficult because of lack of flexibility. Therefore, if the .016 X.022 inch arch wire can be engaged to the slot easily, STAGE 5 can be skipped. If the patient wears the mandibular cervical head gear sufficiently, the anterior cross bite might be corrected in this STAGE. In such a case, the mandibular extraction space can be almost closed by ligating the tie-back hooks to the molars tightly.

Rotational Tie

- Ligate the distal wing of the bracket only.
- Ligate the distal wing of the bracket with elastics.
- Place the elastics in the slot of the mesial wing.
- Ligate the soldered hook made of .025 inch brass wire to the bracket with elastics. When the elastic force cause the mesial migration of the arch wire, the tie-back should be placed.

STAGE 6 Mesial movement of the maxillary molars and Anterior contraction or retraction or Lingual movement of the mandibular incisors.

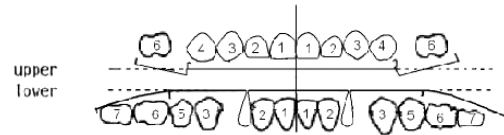
Maxilla: The same wire with STAGE 4.

Mandible: .016x.022 inch rectangular wire with loops. (closing arch wire.)

Objective

- Maxillary space closing by mesial movement of molars.
- Mandibular space closing and correction of anterior cross bite by lingual movement of incisors.
- Adjustment of third order bend.

Design



- The arch wire is made IDEAL in form and the THIRD ORDER BEND is incorporated.
- The TIP-BACK BEND AND TOE-IN BEND is more activated than IDEAL arch wire.
- Check the coordination of the upper and lower arch wires⁷.
- The space closure and the molar relationship are checked and the class III elastics are placed if necessary.

Mandible

- The BENT-IN VERTICAL CONTRACTION LOOPS are placed 1 mm distal to the lateral brackets, both legs being 5 mm in length.
- The OFF-SET BEND and TOE-IN BEND are placed mesially as the posterior segment of the arch wire are moved distally by activating the vertical loops.
- The TIE-BACK HOOKS made .025 brass wire are soldered to the GINGIVAL surface of the arch wire on the OFF-SET BENDS between the first premolars and the first molars.
- The arch wire has the SECOND ORDER BEND as STAGE 5.

LIGATURE

- FIGURE-EIGHT TIE: same as STAGE 5.
- SINGLE TIE: Tightly
- TIE BACK

Maxilla: Ligate from the first molars to the HOOKS with elastics.

Mandible: Ligate from the first molars to the HOOKS opening the vertical loops 1mm on each side.

- CINCH BACK (U/L)

Check point

- The lower incisors should be moved lingually and the excessive lingual inclination of the upper and lower incisors should be avoided.
- The maxillary first molar should be moved mesially without mesial tipping.
- The molar relationship becomes class I
- The adequacy of third order bend should be checked.
- Check the vertical contraction loops that are active without permanent distortion. The vertical loop should not be activated more than 1 mm.
- Continue this STAGE until the extraction spaces are closed.

Necessary observations

In this STAGE, the anterior cross bite is corrected with lingual

movement of mandibular incisors by activating the mandibular vertical loops. But the mandibular vertical contraction loop should not be activated more than 1 mm, if the amount of the activation is too much, the teeth have the tendency to incline towards the space (loop), and the posterior segment might move mesially (anchorage loss).

The final objective of this STAGE is space closing and correction of anterior cross bite and establishment of class I molar relationship and straight midline.

Maxillary space is closed with mesial movement of molars by ligating the tie-back hook to the molar bracket with elastics. Observing the changes in of molar relationship, the activation of the vertical loops and class III elastics and the mandibular extra oral appliance should be controlled.

After the correction of anterior cross bite, the proper overbite should be controlled by up and down elastics.

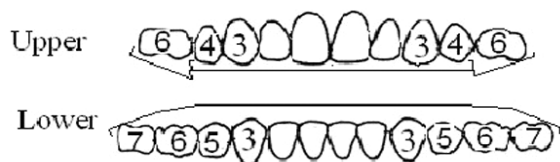
Vertical loops should not be activated after space closing (if activated, the posterior segment may flare to the lateral.)

STAGE 7 (1) Establishment of Occlusion (Ideal arch)

Maxilla: .018 X 022, .017 X.025 inch Ideal arch

Mandible: .018 X 022, 017 X.025 inch Ideal arch

Objective: Final detailing of the occlusion with the ideal arch.



1. The arch wire is made IDEAL in form.
2. SECOND ORDER BENDS together with TIP-BACK BENDS are incorporated.
3. THIRD ORDER BENDS are incorporated.
4. The arch wire is HEAT TREATED to GOLDEN WHEAT COLOR.
5. HOOKS made of .025 inch brass wire are soldered to the GINGIVAL surface of the arch wire at the contact areas between the lateral incisors and the cuspids, if needed.
6. HOOKS made of .025 inch brass wire are soldered to the GINGIVAL surface of the arch wire on the OFF-SET BENDS between the second premolars and the first molars for tie-back.
7. Check the coordination of the upper and lower arch wires

Ligation

1. The figure eight tie is removed.
2. The arch wire is ligated tightly.

3. The upper and lower arch wires are tied back to close any space left.

Check point

Check the occlusal relationship of all the teeth from the labial and lingual side. Adjust the 1st, 2nd and 3rd bend for final detailing.

1. Inclination: Check the inclination of all teeth on the panoramic x-ray films.
2. Midline deviation and mesiodistal dental arch relationship: If exist, use the elastics (class II elastics, class III elastics, oblique elastics).
3. Interdigitation: Use the up and down elastics.
4. Torque: When the torque is insufficient, use the .018x.025 full size rectangular wire.

Necessary observations

For final detailing of the occlusion, IDEAL ARCH is placed in this STAGE. Check the position of canines and molars (especially bucco-lingual position) compared with the original plaster model.

If the occlusion seems to be established sufficiently, the cephalograms and the panoramic x-ray films are taken and the labio-lingual position of incisors and the root paralleling (especially canines and premolars adjacent teeth to the extraction site) should be checked. The plaster models should be taken and the occlusal relationship of all the teeth from the labial and lingual side should be checked and the arch wire is adjusted for final detailing.

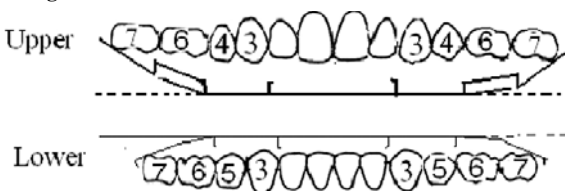
Not only the static occlusion, the dynamic (functional) occlusion should be checked so that, there is no occlusal interference in centric relation and the canine protection is shown in eccentric occlusion. When all the static and dynamic occlusion is established, this STAGE is finished. This series of treatment is rather mechanical. So, before removing the multibonded appliance, .016 inch round wire can be used to allow the teeth to settle in their physiological position before retention.

STAGE 7 (2) Alignment of the maxillary second molars

Maxilla: .016 X .022 inch bypass wire are soldered to the ideal arch.

Objective: Alignment of the maxillary second molars.

Design



The BYPASS WIRES are soldered to the gingival surface of the arch wire on the OFF-SET BENDS between the first premolars and the first molars.

Ligation

1. The arch wire is ligated tightly.
2. The upper and lower arch wires are tied back.

Check point

1. The BYPASS WIRE should be adjusted not to cause trauma to the cheek or gingiva.
2. The BYPASS WIRE should not be heated when soldered.

Comment

In this case, the maxillary second molars were not included in the appliances until the maxillary extraction space is closed. Otherwise, the maxillary second molars may inhibit or retard the mesial movement of the first molars. The BYPASS WIRE is effective when only one tooth is expected to be moved.

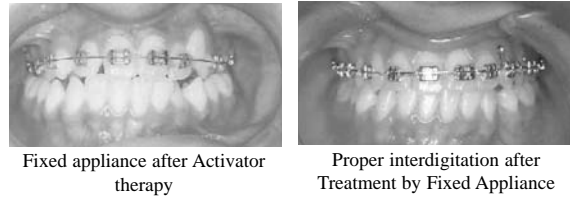
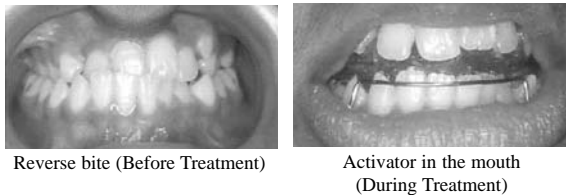
STAGE 8 Removal of the brackets and bands for Retention

Maxilla: Following the removal of the bands and brackets, impression is taken to construct the removable acrylic retainer. Retainer has to be placed as soon as possible. If it takes long time after bands and brackets removal, not only the fitness of the retainer becomes worse but also the relapse might occur. Recently, as the brackets and tubes are bonded to the teeth directly instead of the bands, the impression is usually taken without removal of the bands and brackets and make the retainer after the grinding of the brackets on the plaster models.

Mandible: The removable acrylic retainer can be used as the maxilla, but the fixed canine-to-canine retainer is common. But the traditional cuspid-to-cuspid retainer cannot prevent either the labial inclination of the incisors or crowding or the relapse of the extracted space of the first premolars. Thus the bonding of multi-threaded wire to all the teeth between the right and left second premolars is recommended.

The multithreaded wire method can be used to the maxilla, but the position of the wire has to be decided considering the contact point of the lower teeth.

CASE :1 The case was treated in two STAGE technique - the class III activator was followed by fixed appliance technique to give better interdigitation.



CASE 2 : The case was treated in two STAGE technique - the class III activator was followed by fixed appliance technique to give better interdigitation.

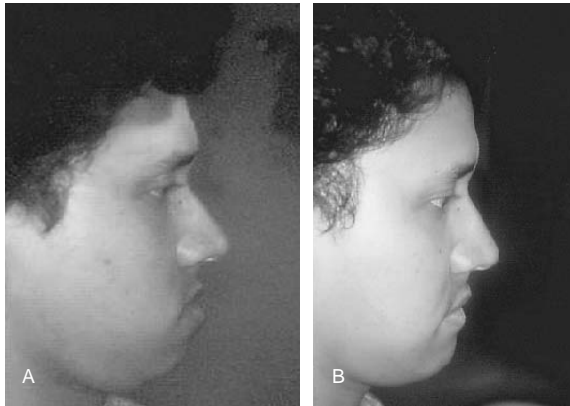


Fig. 1 : A. Face Profile appears concave & Pre-maxillary depression & maxillary protrusion is much prominent. B. Face profile has been improved. Pre-maxilla has been elevated & chin has been retruded to make the profile straight.

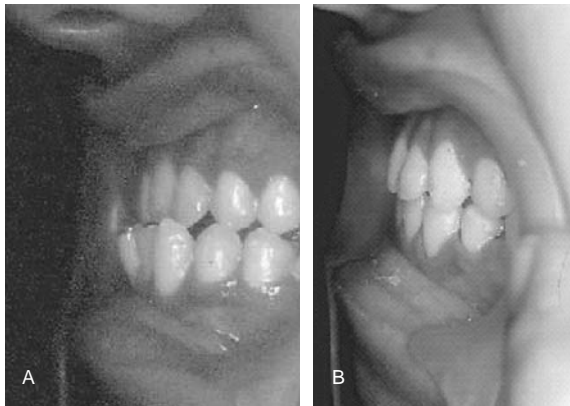


Fig. 1 : A. Dental profile (Before treatment) shows, reverse OB & OJ, depressed pre-maxilla, very poor cuspal relationship. B: (After treatment) shows correction of reverse OB & OJ . Also given normal OB & OJ, pre-maxilla has been elevated. & better cuspal relationship has been established.



Fig. 3 : A,B,C.(Before treatment) Intra-oral frontal, Lt side, Rt. Side view shows , Class III dental relations, reverse OB & OJ, signs of traumatic bite and attrition, left sided mandibular deviation, mid-line shifting., poor cuspal relations.

Fig. 4 : Fixed appliance and Lower contraction arch at the end of active treatment.

Fig. 5 : Frontal view after completion. of the treatment..Note: all signs have disappeared as shown in Fig. 3

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