Case Report Review: Treatment of Class III with RME/FM and/or Skeletal Anchorage

A. Introduction

The author was recently invited to speak at the 2012 Damon Forum on the topic of Class III treatment. In response to many comments received during the lecture as well as throughout the conference regarding the effectiveness of the Damon system for Class III treatment, the author aims to provide a literature review of case reports on Class III treatment. Personal comments are also provided for each case. The author argues that, based on extensive personal clinical experiences, patients of easy to moderate Class III conditions present no needs for complex protocols or devices, such as RME/FM, mini-plate/FM, mini-plate/mini-plate. For severe Class III cases, early treatment with RME/FM, mini-plate/FM, mini-plate/mini-plate can provide short term therapeutic effects, but the result will be compromised by further mandibular growth. So far no appliances have been proven to have sustainable effects on stopping mandibular growth later in time. On the other hand, for adult patients with an orthognathic or acceptable mild prognathic profile, the powerful light force Damon system (*Fig. 2*), and the combined use of buccal shelf mini-screws (*Figures 1, 3*), can provide satisfactory camouflage treatment results without orthognathic surgeries.

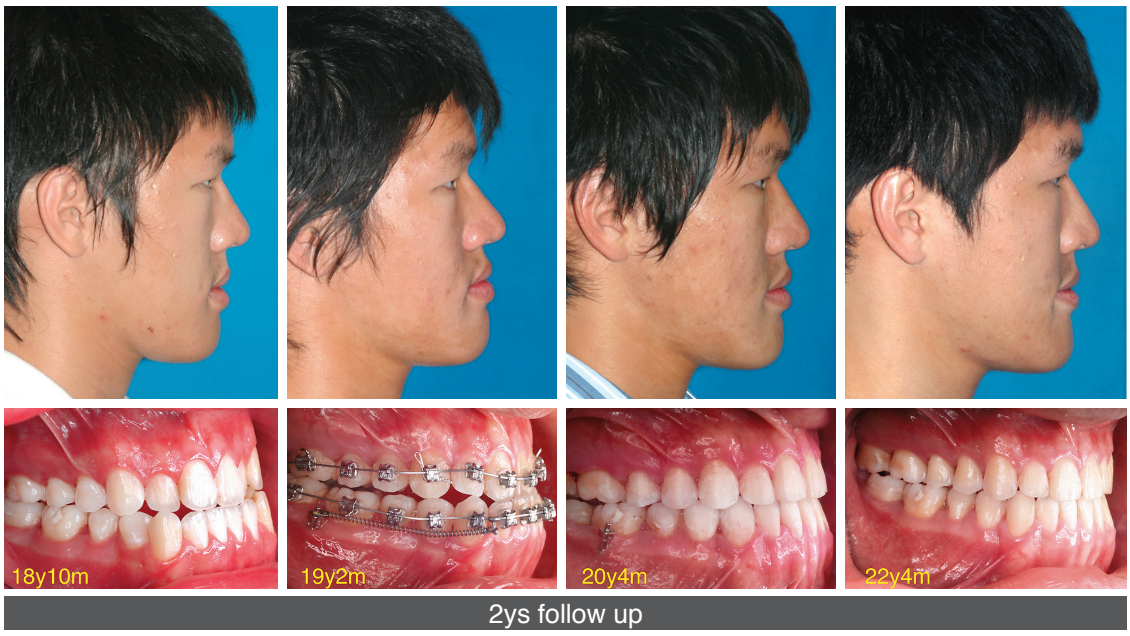

Fig.1:

A severe Class III patient with an orthognathic profile. As long as the patient can accept the original profile, he can be treated with extra-alveolar bucal shelf bone screws. After this case, the author re-evaluated many cases originally treated with buccal shelf mini-screws.

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B. Cases Report Analysis from the Literature

Summary of Class III Treatment

#	Author	Age & Diagnosis	Summary of Comments
C1	Turley 1988, 1996 (*RME/FM*)	Case 1 Mild CIII, CO prognathic profle. 7y3m - ?	No CR orthognathic profle, suitable for regular edgewise appliances.
		Case 2 Severe CIII sub, long term follow up. 9y1m -?	RME/FM cannot have orthopedic effect on severe prognathic Class III patients.
C2	Hong 2005 (*Onplant/FM*)	Severe CIII sub with prognathic profle. 11y5m - 12y5m Maxillary retrusion	Lack of long term follow up, should be a simple extraction case which need long term follow up.
C3	Hsu et al. 2008 (*Alt-RAMEC/FM*)	• Severe CIII sub with prognathic profle. • Skeletal Class III with maxillary defciency 11y8m - 15y6m	• Maxillary protraction cannot stop late mandibular growth. Relapse already at Age 15y6m. • Alt-RAMEC protocol cannot change the prognathic profle. • Need long term followup, re-treatment by surgery is indicated if an orthognathic profle is desired.
C4	Cha et al. 2011 (*mini-plate/FM*)	A skeletal Class III with maxillary defciency and mandibular prognathism. 8y5m - 14y ?	• Lack of long term follow up. • Without details on age. • Waste of precious lower E-space.
C5	Küçükkeleş N, et al 2011 (*Le Fort I+RME/FM*)	Class I anterior crossbite.	Should be an easy anterior crossbite treatment, by using the E-space, no need for Le Fort I surgery.
C6	Hugo De Clerck (*mini-plate/mini-plate*)	Case 1 Class III with functional shift 10y - 11y8m	No beginning CR profle, should be an easy orthodontic case.
		Case 2 Class I, 10y2m - 12y1m	Creates CII problem. Over treatment to Class II, no need.
		Case 3 Severe Class III sub 11y - 15y9m	Severe one, the prognathic profle and asymmetry will relapse.
C7	Wilmes B. 2011 (*Hybrid Hyrax/ Mento-plate*)	Case 1 Severe CIII Sub 9y - 9y9m	Waste of lower E-space, severe CIII Sub, needs long term follow up.
		Case 2 Severe crowding case 12y - 13y8m	Can be treated with Damon by nonextraction therapy.

C1 RME/FM = Rapid Maxillary Expansion + Face Mask protraction.

C2 Onplant/FM = Palatal onplant + Face Mask protraction.

C3 Alt-RAMEC = Liou's Alternate Rapid Maxillary Expansions and Constrictions.

C4 Mini-plate over the zygomatic region.

C6 Mini-Plate/Mini-Plate = Hugo De Clerck's zygomatic mini-plate to lower canine region mini-plate, using Class III elastics.

C7 Hybrid Hyrax = Mini-screw reinforced Hyrax, as upper molar skeletal anchorage. Mentoplate with two extensions for Class III elastics.

Fig. 2A:

Another severe Class III with orthognathic profile. The relative narrow upper arch was corrected purely in the Damon system.

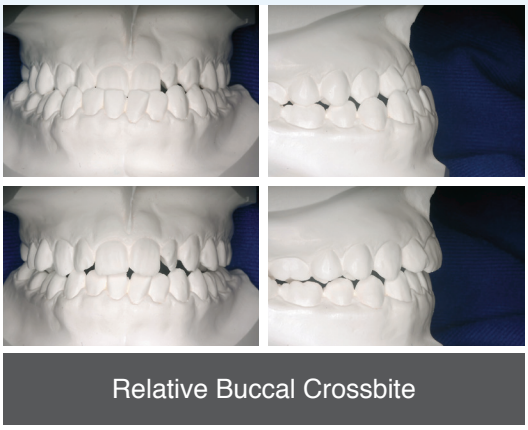

Fig. 2B:

By positioning the model from a Cl III relationship to Cl, the buccal crossbite could not be noticed. This suggests that the significant buccal crossbite can sometime be a relative buccal crossbite. As long as the anteroposterior problem is solved, the transverse buccal crossbite can also be alleviated. No RME is needed in this case.

Fig. 2C:

This case was treated with the Damon system only.

Fig. 2D:

No TADs were used in this case.

Fig. 3:

This severe Class III open bite was treated with the Damon system combined with buccal shelf mini-screws.

C1. Turley's Cases

Orthopedic Correction of Class III Malocclusion with Palatal Expansion and Custom Protraction Headgear. Turley PK. J Clin Orthod. 1988 May;22(5):314-25.	Orthopedic Correction of Class III Malocclusion: Retention and Phase II Therapy. Turley PK. J Clin Orthod. 1996 Jun;30(6):313-24.

Basic Information

Two Class III cases with long term follow up.

Case 1: A mild Class III case. Although the profile seems prognathic, the author suspects there might be functional shift at the beginning of treatment, contributing to a seemingly prognathic profile.

If considering the Class III malocclusion, it can be corrected easily with traditional fixed appliance.

Case 2: At the beginning, the patient has maxillary retrusion and severe prognathic mandible. In addition, the chin deviates to the right. This should be a case with very poor prognosis.

Lin's Comment

Case 1: The patient first presented as a mild Class III case. One should not be misled by the prognathic CO profile. Simple edgewise appliances can provide good long term results without using RME/FM. If the lower E-space can be maintained and used, the treatment will be much easier.

Case 2: This is a severe Class III subdivision case. After treatment, the mandible continued to grow further asymmetrically. Notice that, after phase I treatment, the chin still deviated to the right, and the profile became more prognathic. The lower dental midline also deviated to the right, coinciding with the chin deviation. The author suspects the follow up would find the chin continued to deviate to the right as most Class III asymmetry cases do. Eventually Dr. Turley had to remove the delayed exfoliated left lower 2nd deciduous molar(*with congenital missing of the left lower 2nd premolar*) to correct the relapsed anterior crossbite and lower dental midline by using the edentulous space of lower 2nd premolar.

Unfortunately in the two articles, there was no further information about the relapse of this Class III subdivision case. Although the edentulous lower 2nd premolar space was used to correct midline relapse and achieved an acceptable occlusal relationship, the profile has become more prognathic and presents asymmetric chin point. This case provided an example of failed orthopedic correction. For this type of severe Class III sub case, it is impossible to achieve the so-called orthopedic correction by RME/FM.

C2. Hong's Case

Use of onplants as stable anchorage for facemask treatment: a case report. Hong H, et al. Angle Orthod. 2005 May;75(3):453-60.

Basic information

Diagnosis: Maxillary retrusion with hypoplasia of the infraorbital region.

Only one case used the palatal onplant anchorage and a face mask.

Treatment time: 1 year of treatment, no follow up.

Diagnosis:

(1) Buccal occlusion severe Class III relationship on the right while buccal occlusion Class II relationship on the left.

(2) There is an impacted left upper canine. The upper midline deviated to the left due to this impacted canine. If the left upper canine were not impacted, the upper midline would have been more on the right side and the upper and lower dental midline would have been even more deviated.

(3) The occlusal characteristics provided above indicate a severe Class III subdivision case and poor prognosis due to future growth.

(4) Lower lip protrusion was noted, and the chin deviated to the left.

Treatment results:

Though there was no individual forward movement of the maxillary molars and minimal extrusion of the maxillary molars, the maxilla was still displaced forward.

The upper lip became more protruded after treatment which makes her bidental protrusion more prominent. Also the left upper impacted canine and both arch crowding were not aligned yet. In order to improve dental and facial profile, four bicuspids extraction will be indicated.

Lin's Comments:

(1) The original diagnosis has over-emphasized maxillary retrusion, and neglected the severe asymmetry and maxillary arch space deficiency.

(2) This is a severe Class III subdivision asymmetry case. The asymmetry will intensify during the active growth period. The onplant and protraction cannot correct the asymmetric growth at all.

(3) If we consider the impacted left upper canine, no matter how far the maxillary dentition is protracted, the midline is still severely deviated.

(4) Alternative treatment option can be, four bicuspid extraction to correct the right side Class III malocclusion. This way space can be gained for the eruption of impacted left upper canine and simplify the treatment. No onplant/FM will be needed. However, considering this was a severe Class III sub case, the chance of re-treatment is quite high.

C3. Hsu's Case

A Case Report. Doubled hinged rapid maxillary expander using alternate rapid maxillary expansions and constrictions, combined with face mask protraction, dental skeletal evaluation. Hsu MJ et al. J. Taiwan Assoc Orthod 20(2):42-53, 2008.

Basic Information

Diagnosis: 11y8m - 15y6m

Skeletal Class III with maxillary deficiency, cleft lip and palate with maxillary hypoplasia.

Treatment:

The Alt-RAMEC/FM combined protocol is very effective in the correction of severe Class III cases. However, the follow up after 1 year and 2 months already revealed obvious relapse at the age of 15 years and 6 months.

Lin's Comments:

(1) Dr. Eric Liou's unique Alt-RAMEC/FM method attracted a lot of attention worldwide. Orthodontists in Australia, Italy and the US have tried to repeat this method. Neither Dr. Liou's nor those following cases provided long term follow up results.

(2) Although this is an effective way of treating severe Class III, it does not change the patient's original prognathic profile. The diagnosis has over-emphasized maxillary deficiency and neglected severe mandibular protrusion at the beginning.

(3) At 14 years and 4 months, the profile is still prognathic. Although at 15 years and 6 months, the post treatment profile seems to be much improved, it is mainly due to postural change.

(4) One should notice that at 15 years and 6 months, the bite already relapsed to an edge to edge relationship, and there are 2 to 3 years more before late mandibular growth completed. The occlusion will worsen in time.

C4. Cha's Case

Maxillary protraction with miniplates providing skeletal anchorage in a growing Class III patient. Cha BK, et al. Am J Orthod Dentofacial Orthop. 2011 Jan;139(1):99-112.

Basic Information

This is a female, Class III sub case, aged 8 years and 5 months, with her chin deviating to the right side. She underwent 14 months of miniplate/FM protraction with fixed appliance treatment and was in follow up for 27 months. No exact age was indicated in the final record. It is estimated the final record was taken at around 14 years old .

Lin's Comments

(1) The protracted face has bidental protrusion. If the chief complaint was bidental protrusion, then 4 premolars extraction might be a better treatment option This way one could use a much simpler approach without involving traumatic invasive miniplate/FM appliances.

(2) If the patient preferred nonextraction treatment, then the lower lingual arch could be placed in the lower arch to keep the large E-space on the lower arch. After permanent dentition formed completely, the anterior crossbite could be corrected mostly by retraction of lower dentition by using the E-space. Lip protrusion on both upper and lower side could simultaneously be alleviated. Hence, there is no need for traumatic invasive mini-plate/FM treatment in this case.

(3) The original diagnosis over-emphasized maxillary deficiency and failed to consider the original severe dental and skeletal asymmetry. Notice that, after 14 months of protraction treatment, the skeletal and dental midline was still off. 27 months after appliance removal, the skeletal and dental midline was still off and it will worsen during active growth. In this case the invasive and traumatic mini-plate / protraction treatment did not lead to a satisfactory result.

C5. Küçükkeleş's Case

Rapid maxillary expansion compared to surgery for assistance in maxillary face mask protraction. Küçükkeleş N, et al. Angle Orthod. 2011 Jan;81(1):42-49.

Basic Information

This study compared 18 cases treated by RME/FM versus 16 cases treated by incomplete Le Fort I osteotomy and RME/FM. The conclusion of this study finds that the surgically assisted FM treatment was more rapid and effective in maxillary protraction compared to the RME and FM treatment.

Lin's Comments

1. In the article the author only presented one case treated with incomplete Le Fort I + RME/FM when this female patient had a straight profile, plenty of E-space, Class I molar and anterior crossbite. This case could be corrected easily with maintaining and using the E-space later on to correct the simple anterior crossbite.

2. For this case, improper diagnosis and inappropriate invasive surgical treatment were executed. One could not help but question the treatment for the other 33 patients. This finding highlights the importance of carefully examining case reports in terms of case classification, diagnosis and long-term results.
3. The patient had been treated from Class I to Class II with a large overjet and a retrognathic profile. It means the original anterior crossbite had been mistreated and became another problem, Class II malocclusion and requires further orthodontic intervention.

C6. De Clerck's Cases

Rapid maxillary expansion compared to surgery for assistance in maxillary face mask protraction. Küçükkeleş N, et al. Angle Orthod. 2011 Jan;81(*1*):42-49.

Basic Information

Case 1: The patient has functional shift and presents a mild Class III relationship. One may suspect it to be an orthognathic profile if the CR is considered.

Case 2: very small mesial step, a borderline Class I case.

Case 3: indeed a very severe Class III asymmetrical case.

Lin's Comment

Case 1: an easy mild Class III, no need to do invasive mini-plate treatment.

Case 2: basically a Class I, been treated to Class II, creates an Class II overjet problem.

Case 3: a very severe Class III.

1. Placing upper mini-plate over infrazygomatic region is not too difficult. However, putting a mini-plate over lower canine region is a very difficult procedure. One needs to avoid damaging the developing lower canine. Overall it's a technic sensitive surgery, especially for a young patient around age 10. Four mini-plates for a young patient is a major comprehensive surgery.
2. It's worthwhile if the procedure indeed can correct severe prognathic Class III permanently. However, the severity of case 3 significantly decreased its successful rate. The follow up records indicate the overjet

was already reduced at the age of 15 years and 9 months and future follow up is expected to find the profile to be more asymmetrical and prognathic (*Fig. 4*).

3. In comparison, case 1 and case 2, in the author's opinion, presented no needs for traumatic invasive surgeries. The Damon system can treat these two cases easily without surgery.
4. In this mini-plate / mini-plate protocol, the treatment result is amazing. But in this system, no RME was used. We have to reassess the need of RME in Class III treatment.

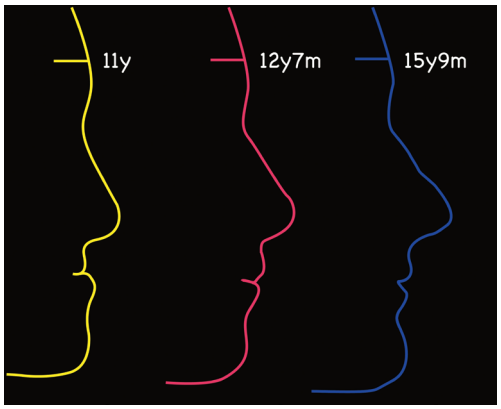

Fig. 4:

From the superimposition of Hugo De Clerck's case 3, at age 15y9m the mandible grew forward a lot, even though the mini-plate/mini-plate Class III elastic had protracted the maxilla a lot forward. Nothing was effective in stopping late mandibular growth. (diagram made from C6 case 3)

C7. Wilmes' Cases

Early Class III treatment with a hybrid hyrax-mentoplate combination. Wilmes B, et al. J Clin Orthod. 2011 Jan;45(*1*):15-21.

Basic Information

Case 1: 9y → 9y9m

This severe Class III subdivision case did not provide complete clinical records with the front facial photo missing.. The patient presented with plenty of lower E-space. In the author's view, there is no need to perform an invasive early treatment. Simply by maintaining the E-space, one can correct the anterior crossbite in a much easier way later.

Case 2: 12y → 13y8m

This is a severe crowding case. Protraction of maxilla is not urgent.

Lin's Comment

1. The facial asymmetry of case 1 worsened after the treatment. Since the patient was just 9 years and 9 months old, the asymmetric growth is unavoidable and therefore makes the treatment result unsustainable. The author prefers to maintain the E-space, after full permanent dentition is complete, and then to start correction of the anterior crossbite by using the E-space.One should carefully monitor the asymmetric growth and re-evaluate in follow up.
2. Case 2 is a severe crowding case. An alternative treatment option is to use the Damon system to align and gain space for the impacted upper right and lower right 2nd premolars to erupt. After the Hybrid-Hyrax / mentoplate treatment, the upper arch became too forward. Protraction of maxillary dentition cannot solve the crowding. For severe crowding cases, one should avoid too much upper anterior protraction. After maxillary protraction treatment, extraction is indicated.

C. Problem of Studies of Class III Treatment

(1) Mis-diagnosis: inaccurate diagnosis of the malocclusion often leads to difficult and unnecessary treatment for easy Class I cases. (*C5, C6*)

(2) Lack of long term follow up: many cases noted in the review presented incomplete records, such as missing detailed age information and long term follow up. For severe Class III, short term early treatment may only provide a temporarily satisfactory but unsustainable result. The evaluation of the treatment effectiveness cannot be made without data from long term follow up. (*C2, C3, C4, C5, C6, C7*)

(3) Waste of precious E-space: for Class III patients with lower E-space, if maintained properly, after permanent dentition is reached, it can be used for retraction of lower dentition, and correction of anterior crossbite. The less protrusive upper incisors can also reduce lower lip protrusion. (*C1, C4, C7*)

(4) Loose definition of maxillary retrusion: classification of malocclusion is often misguided by a prognathic CO profile, without careful examination of the patient's CR profile. (*C1, C2, C3, C4, C5, C6, C7*)

(5) False assumption of a normalized post treatment growth: it is often assumed that growth will be normalized after the protraction of maxillary dentition or skeletal protraction. (*C1, C2, C3, C4, C5, C6, C7*)

(6) Questionable effectiveness of appliances for stopping late mandibular growth: no long term clinical evidence has proven the effectiveness of appliances for stopping the late mandibular growth (*C1, C2, C3, C4, C5, C6, C7*)

D. Conclusion

1. RME/FM is an effective protocol to treat Class III malocclusion, but not too many Class III malocclusion cases require this complex treatment protocol.
2. Patients now have simpler and less painful treatment options, other than RPE, and similar extra-oral appliances.
3. Early treatment cannot prevent relapse due to late mandibular growth.
4. For severe Class III patients with a prognathic CR profile, regardless any intra or extra-oral appliances used, the prognathic profile will not change. Meanwhile, it tends to worsen due to late mandibular growth. If a prognathic profile is acceptable, Damon system can be considered as a simple and effective option with its MEAW-like effect.
5. The Damon system is also effective for young, moderate Class III patients with a good profile..
6. For severe Class III adult patients with a good orthognathic profile, the Damon system alone can achieve a satisfactory camouflage result. For severe Class III open bite patients, the combined use of the Damon system and miniscrews have proven to be a powerful solution in the author's experience (*Fig. 3*).
7. There is no doubt that the use of mini-plate/mini-plate is a more effective way to orthopedically protract the maxilla forward, compared with RME/FM.
8. The biggest problem for Class III studies, is the lack of precise definition of maxillary retrusion. The criteria of deficient maxilla or retrusive maxilla are often subjective and inconsistent. Hence, the conclusions generated from these studies are often questionable.
9. Many of the studies on FM / RME, or mini-plate cases, have put excessive emphasis on the protraction of the maxilla, and neglected the important diagnosis of the original prognathic mandible, and the initial problems of asymmetric growth.

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