Case report

Facemask Early Treatment Followed by Fixed Appliance for An Angle Class III malocclusion – A Long Term Follow Up Case Report

ABSTRACT

Aim: The incidence of Angle Class III malocclusion is about 5- 15% of the Asian population. For Class III early orthodontic treatments, facemask or chin–cap or some removable appliances were often suggested by clinicians. The aim of this report is to discuss the Class III early treatment effect of facemask.
Methods: In this case report, a 10 years old boy with Angle Class III malocclusion was treated with facemask protraction in Phase I then followed by fixed appliance to complete Phase II treatment.
Results: After 1 year of facemask treatment, the anterior cross-bite was corrected and satisfactory profile change achieved. Owing to moderate crowding in early permanent dentition, Phase II treatment using fixed appliance with four first premolar extraction was completed with Class I occlusion at 14 years old. (Treatment changes—SNA: 78 °to 80°; SNB: 79 °to 78°; ANB: from -1°to 2°; Maxilla CCW rotation, palatal plane & functional occlusal plane flattened). And the 13-year post-treatment long term follow-up outcome showed that the occlusion maintained well.
Conclusion: It is pertinent for orthodontists to apply early orthodontic treatment for Angle Class III children. Once the anterior cross-bite has been corrected, the mandibular growth may be guided into a more favorable growth pattern. And hopefully, the achieved occlusion could be maintained into adulthood.

Keywords: Angle Class III malocclusion, Early treatment, Face mask protraction.

1. INTRODUCTION

The prevalence of Angle class III malocclusion for children aged from 5 to 15 years reported by a systematic review varies greatly within different races and geographic regions (ranged from 0 to 26.7%). Among Japanese it was around 14%, for Koreans 9%–19%, and about 1.65% for Taiwanese. Chinese and Malaysian populations have a higher prevalence of Angle class III malocclusion (15.69%, and 16.59%, respectively), while Indian populations have a lower prevalence (varied within 0%–4.76%) [1].
Clinically, there are two frequently asked questions: the timing of treatment and which device to use. The main purpose of Class III malocclusion early treatment is to avoid

orthognathic surgery after adulthood and to reduce the complexity of the operation if inevitable. The treatment goal is to provide a better growth development and improve the occlusal relationship (such as correction of the cross bite) or facial esthetics. The important benefits of early treatment should not be denied because of concerns that a few may still require further treatment later [2].
Studies showed that early treatment of Angle's Class III malocclusion by using facemask protraction had improved the skeletal and dental development, but there is still a lack of long term evidence [3].
The patient's cooperation is the key to success for the Class III early treatment and overcorrection is recommended [4]. The possible side effects of facemask treatment described include: extrusion and mesial movement of the upper molars, proclination of the upper incisors, and retroclination of the lower incisors [5,6].
This report is a case of early treatment of Angle's class III malocclusion with facemask and a 13 years long-term follow-up after phase II fixed appliance treatment.

2. PRESENTATION OF CASE

The first visit of this 10.5 years old boy was at February, 2003. The main concern of his family was the anterior cross bite. After initial orthodontic data collection and analysis, the diagnosis of Angle's Class III malocclusion was made. The cephalometric analysis showed that it is not only dental but also skeletal Class III malocclusion. The soft tissue facial profile is a straight profile. There are no TMJ clicking sound and patient denied any history of pain or dysfunction.[**Figure 1].**

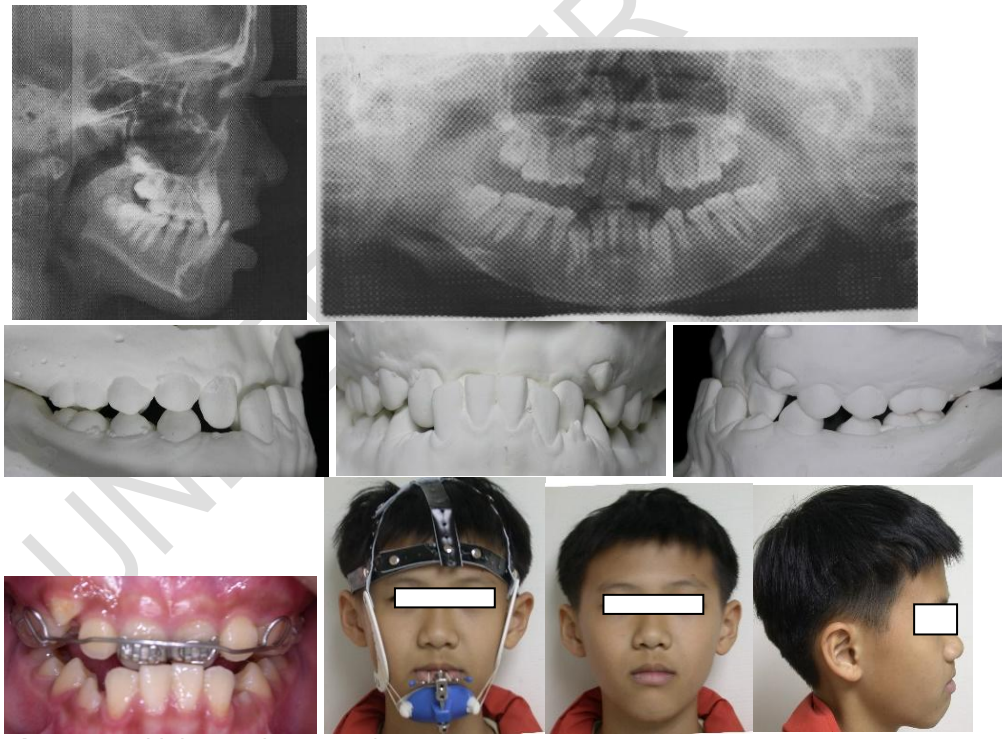

Figure 1. Initial record --- 2003/02;10.5yr

The treatment objectives were addressed as correction of anterior cross bite and Class III malocclusion. The Phase I treatment plan included early therapy with facemask protraction.

After 1 year of facemask treatment, the anterior cross-bite was corrected and satisfactory profile change achieved.

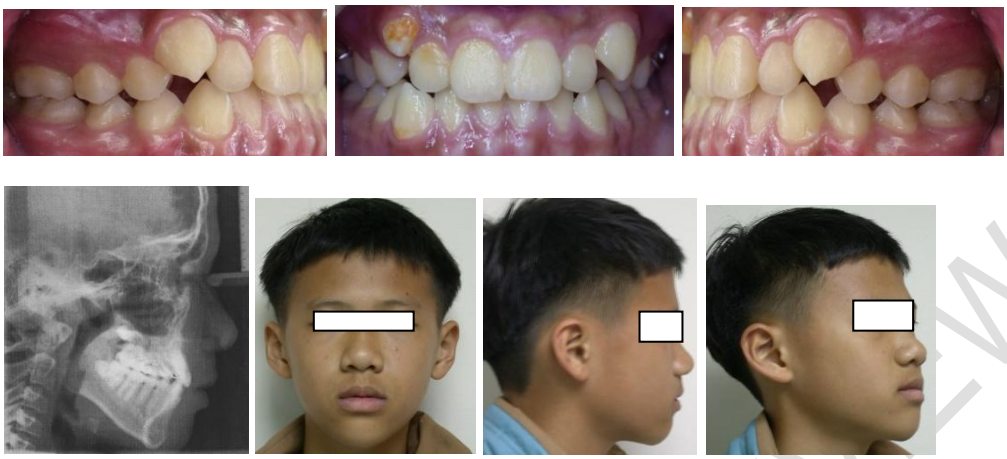

Figure 2. Phase I (facemask therapy) finished --- 2003/11

Owing to moderate crowding in early permanent dentition, Phase II treatment was suggested. The fixed appliance orthodontic treatment with four first premolar extraction was completed at April, 2006 (13.7 years old). The Fixed orthodontic appliance with 0.022'slot (Roth prescription) was used. And loop mechanism applied for space closure.
The treatment changes showed that: SNA from 78 °to 80°; SNB from 79 °to 78°; ANB: from -1°to 2°; Maxilla CCW rotation, palatal plane & functional occlusal plane flattened; and molar Class I occlusion achieved.

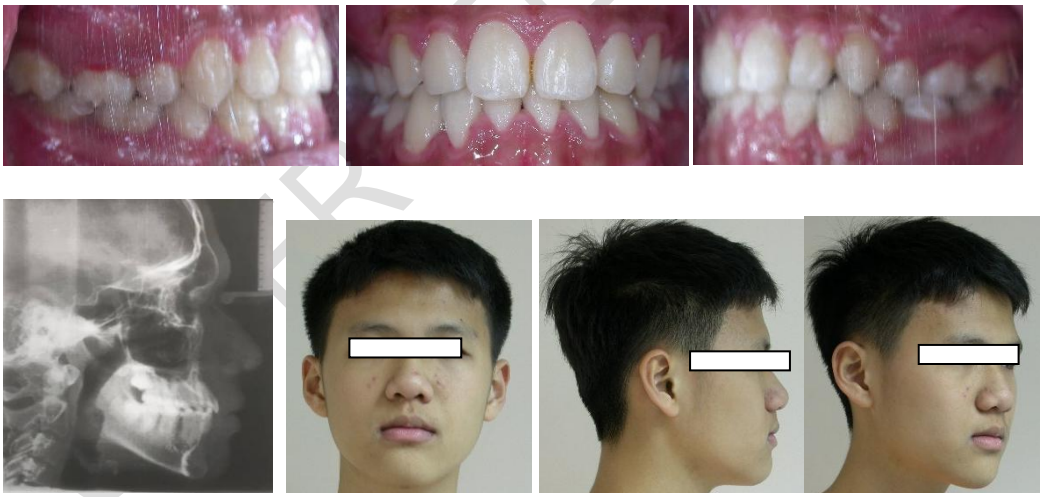

Figure 3. Final record (phase II finished) --- 2006/04; 13yr 8m

The patient came for regular retainer check quite often. And the 13-year post-treatment (at age 26) long term follow-up outcome showed that the occlusion maintained well. The facial profile also remained satisfactory. However, the long-term skeletal change showed that there was still mandible forward growth after age fourteen (Ar-Gn from 110 mm to117mm). The mandibular plane angle decreased noticeable (FMA from 28 °to 22°) due to a more increase at posterior facial height (S-Go from 85 mm to 95mm)
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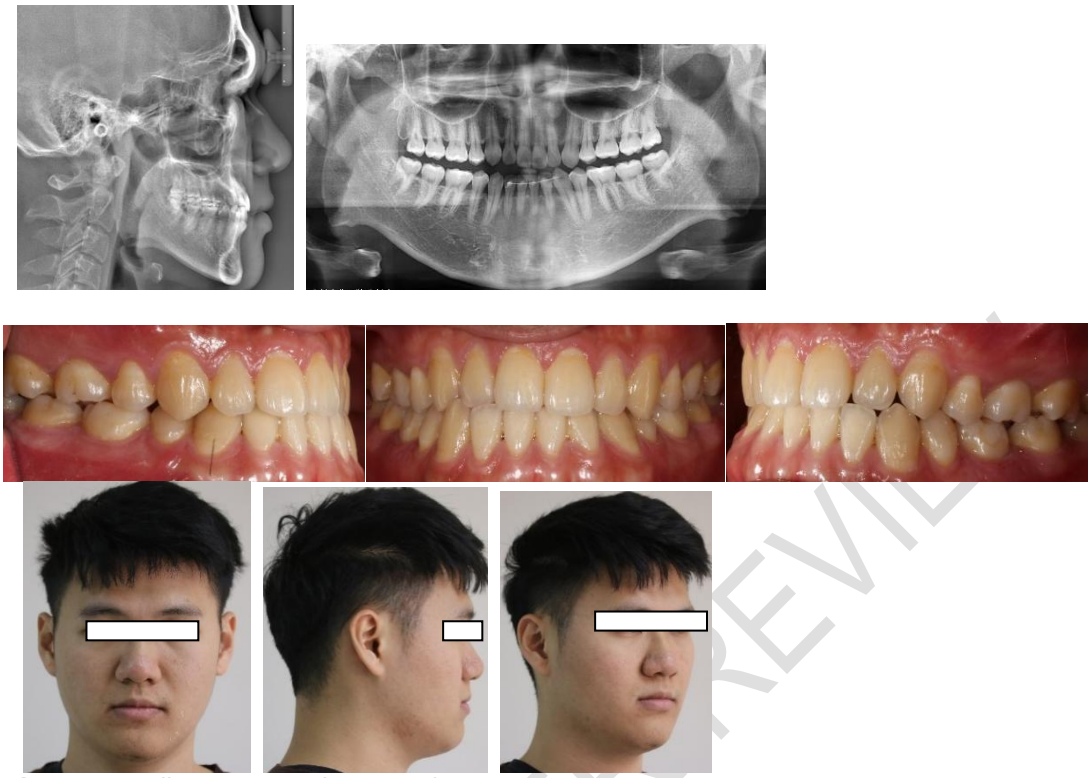

Figure 4. Follow-up record --- 2018/07;26yr

	Initial	Final	F/U
Skeletal			
SNA	79º	80º	82º
SNB	79º	81º	83º
ANB	0º	-1º	-1º
SN-Op	18º	17º	159º
FMA	28º	28º	22º
Ar-Gn	97mm	110mm	117mm
S-Go	68mm	85mm	95mm
Dental			
1-SN	89º	110º	111º
1-NA (deg)	8º	31º	28º
1-NA (mm)	-2mm	5mm	5mm
1- L1	150º	135º	140º
L1-NB (deg)	13º	16º	12º
L1-NB (MM)	4mm	2mm	2mm
IMPA	82º	82º	80º
FMIA	70º	70º	78º
Soft tissue			
Z angle	67º	73º	78º
LL- E plane	4mm	0mm	1mm

Table 1. Cephalometric Analysis (changes between initial, final and follow up)

3. DISCUSSION

The treatment options for correction of Class III malocclusion in growing patients consist of two principal categories: intraoral and extraoral appliances. The intra-oral appliances reported include Class III Elastics with Skeletal Anchorage, Bionator III, Frankel III functional appliance, the Eschler appliance, double-plate appliance and tandem bow appliance (TTBA). The extra-oral appliances used include chin cap, facemask and headgear for mandibular arch. All appliances described above can be useful when the clinicians use them in correct manner [7].

It seems that the most important factor for treatment success of Class III malocclusion in growing patient is case selection. Since approximately 30-40% of Class III patients exhibit some degree of maxillary deficiency; therefore, facemask can be used for maxillary protraction in early orthodontic treatment [7].

For facemask therapy, it is generally recommended by clinician to wear 14 hours a day [8,9]. The optimal force suggested to pull the maxilla forward is about 500-1500 g, which Implied that a heavier force may stimulate the growth of the sutures [10]. The facemask protracted the maxilla forward, which may improve the Class III profile but it also caused the mandible to rotate downward and backward [11]. The rapid palatal expansion (RME) affects the mid-palatal suture and all adjacent perimaxillary sutures, which may promote the treatment effect of facemask. In such belief, managing the developing Class III malocclusion with palatal expansion and facemask therapy was often applied [4].

In 2005, a new method for Class III early treatment was proposed by Eric Liou. His design was to activate/deactivate the palatal expansion device with weekly expansion and weekly contraction, the alternating rapid maxillary expansion and constriction device (Alt-RAMEC) with intraoral maxillary protraction springs [12]. Later on, scholars began to study this new treatment method.

Masucci et al. compared the protraction effect of traditional RME/facemask (FM) with the modified 4-week Alt-RAMEC/FM protocol in deciduous dentition. The results showed that both groups have maxilla advancement, and the Alt-RAMEC/FM group has a greater change (SNA +1.2°, ANB +1.7°). However, there was no significant difference between the two groups in the amounts of skeletal changes of mandible and the vertical relationship [13].

But other literature showed that although facemask is effective correcting Class III malocclusion in the short term (< 3 year) and preliminary rapid palatal expansion does not seem to affect the effectiveness of the orthopedic treatment [14].

One research of facemask treatment changes also advocates a positive influence on sagittal maxillary development, which is not primarily influenced by transverse expansion. Dental side effects are more distinct when no expansion was carried out [11].

The treatment effects of facemask without RME had been explored and no significant differences were noted between two treatment groups (primary vs. mixed dentition). The study concluded that facemask therapy without RME may be postponed to the early to mid-mixed dentition period (Hellman's developmental stages IIA-IIC) or after the first molar of permanent teeth have fully germinated (Hellman's developmental stages, IIIA-IIIB). Since the therapy induces similar skeletal changes when initiated at primary or mixed dentition [15].

Another study compared facemask therapy with and without expansion showed that the forward displacement of the maxilla in both treated groups was significantly greater than in the control group. The increase in the mandibular plane angle and the decrease in the facial axis was significantly different between the FMEXP group and the control group. Molar relationship increased more in the FM group than in the FMEXP group; this was the only significant difference between the treatment groups. In both treatment groups, dental and skeletal treatment changes of subjects with Class lll malocclusion were achieved [16].

Other important factor determining the success of treatment for Class III patients discussed is treatment timing. The dental developmental stage affects the treatment effect of maxillary protraction in skeletal Class III children. According to Saadia, effective maxillary advancement occurs at the time of early treatment (late deciduous or early mixed dentition), at this time the sutures around the maxilla can respond effectively [6].
A systemic review had showed the treatment effect of maxillary protraction in skeletal Class III children was greater in the primary dentition than that in the early mixed dentition with respect to an increase in SNA, ANB and SN/GoGn [17].
The study about orthopedic approach to the treatment of Class III malocclusions in the early mixed dentition showed that a forward displacement of the maxilla resulting in a statistically significant increase ($P < 0.001$) in the SNA angle, A-NPg (mm) and PNS-A (mm) linear values. The beneficial effects on the facial profile were confirmed by a decrease in the facial convexity angle [18].
The randomized controlled trial by Mandall et al. revealed the favorable effect of early class III facemask protraction treatment undertaken in patients under 10 years of age, is maintained at 3-year follow up in terms of ANB (+ 1.5), overjet (+3.6 mm) and PAR (21%) improvement. Seventy percent of patients in PFG group had maintained a positive overjet which was defined as ongoing treatment success. Early protraction facemask treatment does not seem to influence self-esteem or reduce the patient's personal impact of their malocclusion and TMJ signs and symptoms were very low at 3-yenr follow up [19]. (PFG: protraction facemask group)
When the anterior cross-bite is not treated early, studies reported the possibility of periodontal problems in the lower incisors, the presence of discomfort, alteration in the anteroposterior position of the mandible, and problems with the temporomandibular joint (TMJ) [9,10]. Early orthodontic intervention in the mixed dentition can promote the harmonious growth of jaw bones, thereby may reduce the likelihood of severe disorder of the permanent dentition [2].
In a long term (8.5 years) controlled study, rapid maxillary expansion and facemask therapy led to successful outcomes in about 73% of the Class III malocclusion. The treatment group showed significantly smaller increases in mandibular protrusion. It concluded that the favorable skeletal changes were mainly due to significant improvements in the sagittal position of the mandible [20].

4. CONCLUSION

This report is a 13-year long term follow-up Angle's Class III malocclusion case which facemask was used in mixed dentition. This case demonstrates that facemask protraction therapy, as a non-invasive method, can have comprehensively favorable effects on the craniofacial complex and is applicable for treatment in late mixed dentition. Once the anterior cross-bite has been corrected, the mandibular growth may be guided into a more favorable growth pattern. And hopefully, the achieved occlusion could be maintained into adulthood.

CONSENT (WHERE EVER APPLICABLE)

All authors declare that 'written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editorial office/Chief Editor/Editorial Board members of this journal.

ETHICAL APPROVAL (WHERE EVER APPLICABLE)

It is not applicable.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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