

Modified Anterior Traction Appliance for Skeletal Class III Malocclusion with Crowded Upper Posterior Arch

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Abstract: Objective To improve crossbite in the skeletal class III cases with the molar mesial movement in the mixed dentition by the modified anterior traction appliance. Methods 20 cases with skeletal class III malocclusion crowded in the posterior arch were selected from the Department of Orthodontics, Hebei Medical University Stomatology Hospital. Through the appliance, the maxilla can be pulled, and crowding of the posterior arch can be solved by molar distalization. X-ray cephalometric measurement and model measurement were performed before and after treatment to compare the changes of bone, teeth and dental arch during the treatment. Results The experimental results showed that the maxillary hypoplasia was improved, the maxillary crowding was relieved and the molar relationship was corrected. Conclusion The modified anterior traction appliance is effective in the treatment of class III malocclusion, which can further improve the development of maxilla. The space lost in the malocclusion is restored, which provides a better basis for the second stage orthodontic treatment. It is a fast and effective orthopedic treatment method, which can reduce the risk of teeth extracted in the second stage.

1. Introduction

The maxilla is easily affected by the environment and functional factors^[1,2], resulting in the lack of development, such as early loss of primary teeth, bad oral habits, sleeping habits, etc., so there are often a series of complications, such as mesial movement of posterior teeth, crowding of dental arch, and posterior crossbite, which not only affects the normal development of the maxilla, but also causes deviation and molar relationship adjustment during the second stage fixed correction^[3], which may increase the extraction rate. In addition, the middle part of the face of patients with skeletal Class III is often flat and not full, and second-stage extraction will make it more difficult for such patients. If the patients with overgrowth of mandible have second-stage extraction and long-term possible orthognathic, they will become the focus of entanglement by parents and orthodontists.

In this study, we focus on skeletal class III patients in this range. They are in the mixed dentition, and their bones still have potential for growth. There are crowding in the posterior arch segment and mesial movement of molars. With the modified anterior traction appliance, while stimulating maxillary development and the molars distalization, can extend the maxillary width with Haas, so that the crowding in the posterior arch segment can be solved and the molar relationship can be improved, providing good arch condition for the second stage fixed treatment and reducing the probability of second-stage extraction.

2. Material Method

1. Patients from orthodontics department of the Stomatology Hospital of Hebei Medical

University were selected to meet the following conditions:

- 1.1 Reverse occlusion in the mix dentition (8-11 years old)
- 1.2 Skeletal class III ($ANB \leq 0^\circ$)
- 1.3 The presence of the posterior arch segment is crowded
- 1.4 The molars move forward

2. The design of the appliance used by the subjects meets the following conditions: (fig 4)

- 2.1 Maxillary anterior traction;
- 2.2 molar distalization;
- 2.3 Haas expansion (optional)
3. Observation index

3.1 X-ray cephalometric analysis: bone change; tooth change; growth type.

3.2 Crowding degree analysis: crowding degree of dental arch is the difference between the required length of dental arch and the available length of dental arch. The crowding degree in this research was measured from canine to first molar.

3.3 Arch width analysis: The width measurement of the arch is to measure the width of the first premolar and the first molar segment of the measurement model (fig 2); the width measurement of the alveolar base bone is to measure the alveolar bone width of the maxillary first molar segment of the model (fig 3).

4. Statistical analysis: T-test of paired samples was performed using SPSS 20.0, $\alpha=0.05$.

3. Result

Table 1 Skeletal sagittal changes before and after treatment

	Before treatment	After treatment	p value
SNA	78.80333	80.98889	0.429
SNB	80.53889	78.31889	0.007*
ANB	-1.73778	2.671111	0*
APDI	88.98111	83.48444	0.01*
WITS	-7.10444	-4.40111	0.018*
NP-FH	87.59222	84.07667	0.072

P<0.05

Table 2 Tooth inclination changes before and after treatment

	Before treatment	After treatment	p value
U1-SN	102.3433	107.2467	0.02*
L1-MP	87.26444	84.30778	0.038*
U1-NA	23.27111	26.75778	0.082
U1-NAmm	3.074444	4.507778	0.014*
L1-NB	24.48556	22.52778	0.128
L1-NBmm	4.49	4.946667	0.289

P<0.05

Table 3 Growth trend changes before and after treatment

	Before treatment	After treatment	p value
Y-AXIS	61.66	65.71	0.041*
SN-MP	37.37111	40.17889	0.03*
FH-MP	29.87778	34.44444	0.04*
S-G0/N-Me	0.61	0.594444	0.065
ANS-Me/N-Me	0.554444	0.555556	0.834

P<0.05

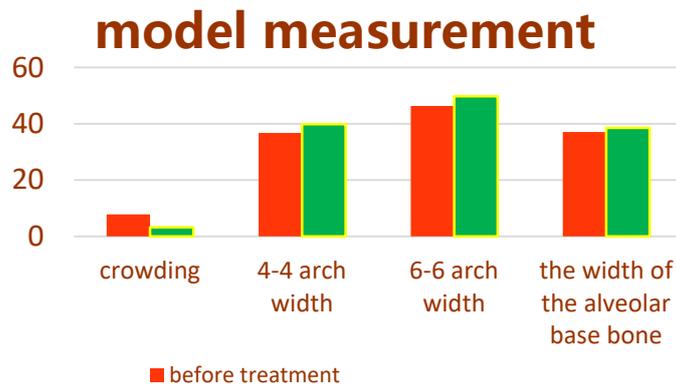


Figure 1 Model measurement changes before and after treatment

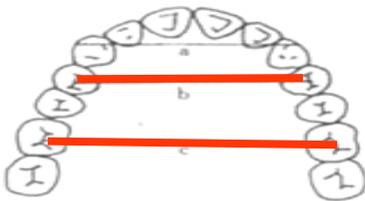


Figure 2 The width of the arch (fig 2)

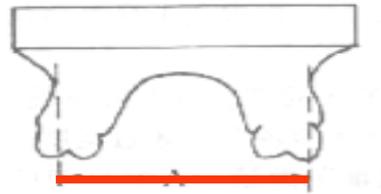


Figure 3 The width of the alveolar base bone(fig 3)



Figure 4 Kinds of the modified anterior traction appliance

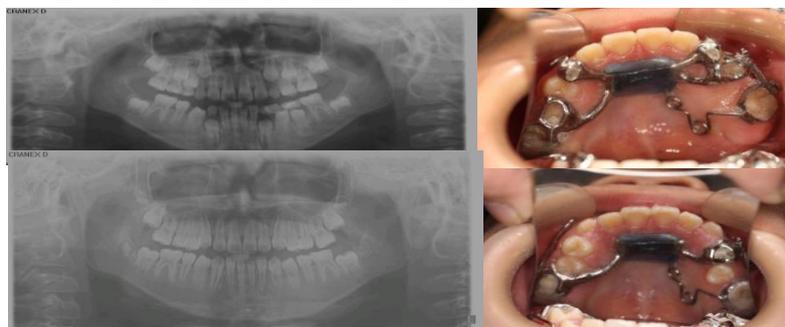


Figure 5 The change of the impacted premolar by this appliance

4. Discuss

Through the observation of the cases, the modified anterior traction appliance is effective for the improvement of skeletal Class III relationship. The results of ANB, APDI, WITS before and after treatment showed that there were significant differences in t test(tab 1), suggesting that the treatment had a positive effect on the orthopedic of jaw. It is very clear that molar distalization^[4-7] can improve the crowding of the posterior arch segment, which is beneficial to the eruption of the impacted teeth caused by crowding, and to the restoration of the molars that move forward, which provides a good molar relationship (fig 5) for the second stage orthodontic treatment of skeletal class III patients, reduces the probability of tooth extraction and improves the class III profile. At the same time, the expansion of maxilla also has a positive effect on the release of crowding, so the result of crowding measurement before and after treatment shows a significant improvement (fig 1). In the whole treatment, the sagittal and horizontal changes of the maxilla were involve, however there was no obvious active interference in the vertical direction. After treatment, the growth trend showed that the occlusion plane increased, and there was a clockwise tendency of skeletal Class III compensation (tab 3). At the same time, the upper and lower anterior teeth also have a certain tendency of Class III compensatory (tab 2). In this research, it is still to be further observed and studied whether there is a difference in the crowding relief between the patients with improved anterior traction combined with expansion and those without expansion.

Reference

- [1] Stability of rapid maxillary expansion and facemask therapy: A long-term controlled study[J].Caterina Masucci,Lorenzo Franchi,Ef시오 Defraia,Manuela Mucedero,Paola Cozza,Tiziano Baccetti. American Journal of Orthodontics & Dentofacial Orthopedics . 2011 (4)
- [2] A follow-up study of early interceptive treatment of primary anterior crossbites[J] . YuanShu Ge,Jin Liu,Xin Guo,JianLi Han. The European Journal of Orthodontics . 2011 (5)
- [3] Soft tissue profile changes following maxillary protraction in Class III subjects[J] . Nihat Kilic,Gulhan Catal,Ali Kiki,Hü,samettin Oktay. The European Journal of Orthodontics . 2010 (4)
- [4] Molar distalization with a pendulum appliance K-loop combination[J] . Ahu Gü,ngö,r Acar,Seda Gü,rsoy,Mü,fide Dinç,er. The European Journal of Orthodontics . 2010 (4)
- [5] Distalization of maxillary molars with the bone-supported pendulum: A clinical study[J] . Sergio Andres Escobar,Paola Andrea Tellez,Cesar Augusto Moncada,Carlos Alberto Villegas,Carlos Mario Latorre,Giovanni Oberti. American Journal of Orthodontics & Dentofacial Orthopedics . 2007 (4)
- [6] Sagittal, vertical, and transverse changes consequent to maxillary molar distalization with the pendulum appliance[J].Acácio Fuziy,Renato Rodrigues de Almeida,Guilherme Janson,Fernanda Angelieri,Arnaldo Pinzan. American Journal of Orthodontics & Dentofacial Orthopedics . 2006 (4)
- [7] Molar distalization with pendulum appliances in the mixed dentition: Effects on the position of unerupted canines and premolars[J].Gero S.M. Kinzinger,Heinrich Wehrbein,Ulrich Gross,Peter R. Diedrich. American Journal of Orthodontics & Dentofacial Orthopedics . 2006 (3)