CASE REPORT

Chin Cup Therapy: An Effective Tool for the Correction of Class III Malocclusion in Mixed and Late Deciduous Dentitions

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ABSTRACT

One of the most perplexing malocclusions to diagnose and treat is the Class III malocclusion, particularly in the late deciduous and mixed dentitions.

A variety of extraoral traction appliances, arch expansion appliances, extraction procedures and functional jaw orthopedic appliances are currently available to the orthodontist for altering the occlusal relationship typically found in Class III malocclusions. Each treatment approach, however, differs in its effect on the skeletal structure of the craniofacial region, sometimes accelerating or limiting the growth of the various structures involved.

An attempt has been made to treat developing Class III malocclusions by chin cup therapy. The chin cup is relatively old orthopedic appliance, used as an interceptive procedure. At the very least, it may serve to prevent worsening the malocclusion. Early prevention is the aim!

Keywords: Class III malocclusion, Chin cup, Mixed dentition, Interceptive orthodontics.

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INTRODUCTION

One of the most perplexing malocclusion to diagnose and treat is the Class III malocclusion, particularly in the mixed and late deciduous dentitions. This occlusion problem is identified easily, not only by dental specialists and general dentists but also by the lay public and often stimulates a parent to seek orthodontic treatment for his or her child.

Many treatment approaches are currently available to the orthodontist for altering the occlusal relationship typically found in Class III malocclusions. These treatments include a variety of extraoral traction appliances, arch expansion appliances, extraction procedures, and functional jaw orthopedic appliances. Each treatment approach, however, differs in its effect on the skeletal structure of the craniofacial region.

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COMPONENTS OF CLASS III MALOCCLUSION

1. Mandibular skeletal protrusion (prognathism), commonly cited as a major skeletal aberration in individuals with Class III malocclusion.
2. Maxillary skeletal retrusion.
3. A combination of maxillary skeletal retrusion and mandibular skeletal protrusion.

Other areas within the faces of Class III individuals exhibited consistently significant differences from a comparison Class I cases, including larger mandibular plane angles, larger gonial angles, longer mandibles, and compensations of the dentition, including maxillary dentoalveolar protrusion and mandibular dentoalveolar retrusion.

OBJECTIVES OF TREATMENT

In Class III malocclusion, it is the treatment objective to restrain all possible horizontal mandibular growth, or at least redirect it into a more vertical vector as the maxilla continues to grow downward and forward. Since Class III faces tend to become more prognathic, and cause unfavorable muscle and tooth adjustments, it is good interceptive dentofacial orthopedics to place appliances early where there is Class III malocclusion. Therapy should eliminate the malrelationship in any event. Many pseudo Class III cases have a tendency to become full blown Class III later on during the growth period unless treated.

The ideal patient for chin cup or functional appliance treatment of excessive mandibular growth has:

1. A mild skeletal problem with the ability to bring the incisors end-to-end or nearly so
2. Short vertical face height
3. Normally positioned or protrusive, but not retrusive lower incisors.

What chin cup therapy does accomplish is lingual tipping of the lower incisors as a result of the pressure of the appliance on the lower lip and dentition and a change in the direction of mandibular growth, rotating the chin down and back. Children who have increased lower anterior face height and are treated with chin cups may end up with skeletal open bites after treatment. Chin cups are divided into two types:

1. The occipital-pull chin cup, more frequently used in cases of mandibular prognathism and,
2. Vertical-pull chin cup that is used in cases of steep mandibular plane angle and excessive anterior facial height, the so-called "backward rotator" patient with openbite.

The time duration of chin cup wear depends on the age when the appliance is placed and the magnitude of the malocclusion as well as the amount and direction of growth at the time.

After the correction of a pre-existing anterior crossbite has been accomplished, the patient wears the appliance during the night only as a retention appliance.

CASE REPORTS

Case 1

A female patient aged 7 years reported to the Department of Orthodontics and Dentofacial Orthopedics with a chief complaint of forwardly placed lower front teeth.

On examination, she was brachyfacial, had a concave profile, an everted lower lip with a deep mentolabial sulcus (Fig. 1). Intraorally, she had a mesial step terminal plane on right and left side. The overjet was 1 mm and overbite was also 1 mm with a posterior crossbite on right side (Fig. 2).

Cephalometric analysis showed a Class III skeletal tendency, a horizontal growth pattern, a decreased lower anterior facial height and proclined upper and lower incisors (Table 1).

The patient was treated with a chin cup therapy (Fig. 3) with a slow maxillary expansion (SME) screw to correct right side posterior crossbite along with Z spring to procline the left central incisor for the correction of anterior crossbite.

After 11 months of treatment, forward growth of maxilla was observed with restricted growth of mandible and a normal interarch relationship with increased lower anterior facial height obtained (Figs 4 and 5). We have a follow-up of almost 2 years post-treatment (Fig. 6).

Presently, the patient is wearing chin cup only at night time for retention. Fixed mechnotherapy will be initiated after eruption of all permanent teeth, if required.

Case 2

A male patient aged 10 years reported to the Department of Orthodontics and Dentofacial Orthopedics with a chief complaint of forwardly placed lower front teeth.

On examination, he was found mesofacial, had a concave profile, an everted lower lip with a deep mentolabial sulcus (Fig. 7).

Intraorally, he had a mesial step terminal plane on right and left side. The overjet was 1 mm and overbite was 2 mm with mildly crowded lower anterior teeth (Fig. 8).

Cephalometric analysis showed a Class III skeletal tendency, a horizontal growth pattern, a decreased lower anterior facial height and proclinated upper and lower incisors (Table 2).

The patient was treated with a chin cup therapy (Fig. 9).

After 13 months of treatment, forward growth of maxilla was observed with restricted growth of mandible and a normal interarch relationship with increased lower anterior facial height obtained (Figs 10 and 11). We have a follow-up of almost 1 year post-treatment (Fig. 12).

Presently, the patient is wearing chin cup only at night time for retention. Fixed mechnotherapy will be initiated after eruption of all permanent teeth.

DISCUSSION

The question concerning the ability to alter the mandibular growth pattern with a chin cup should be regarded in the light of all the variables that may influence growth. Previous studies on the effects of the chin cup force on growing human mandibles have reported various results. There have been a number of clinical studies that have evaluated the treatment effects produced by chin cup therapy.[1-4] These studies have shown treatment effects that are somewhat distinct from those discussed earlier regarding the orthopedic facial mask and the FR-3 of Frankel.

One of the substantive concerns, particularly in the treatment of the patient with mandibular prognathism, is whether the growth of the mandible can be retarded during treatment. Wendell[2] et al (1985) have noted decrease in mandibular growth during treatment. Wendell[2] et al when examining a group of Class III patients treated in the mixed dentition noted that mandibular length increased for the treated group were only 60 to 68% of the control group. Mitani and Fukazawa[3] (1976) noted no differences in mandibular length in Class III patients who began treatment during the adolescent growth period. These findings support the observations of Sakamoto[1] (1981) and Sugawara[4] et al (1990) who advocate the use of the occipital-pull chin cup as early as is practical. Whether the ultimate length of the mandible can be influenced by chin cup therapy still remains unclear.

The reason for choosing chin cup therapy for both the cases was that, both were growing individuals:

1. Having mixed dentition

Fig. 1: Pretreatment extraoral (case 1)

Fig. 2: Pretreatment intraoral (case 1)

Fig. 3: With chin cup (case 1)

Fig. 4: Post-treatment extraoral (case 1)

Fig. 5: Post-treatment intraoral (case 1)

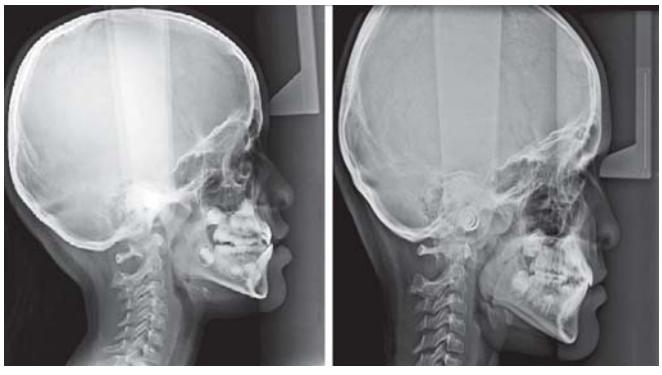

Fig. 6: Pretreatment and post-treatment lateral cephalogram (case 1)

2. Having anterior crossbite with the ability to bring their incisors edge-to-edge
3. Having short vertical facial height
4. Having proclinated lower incisors.

It was there in back of our mind that chin cup therapy does accomplish the lingual tipping of the lower incisors and redirect the mandibular growth by rotating the chin downward and backward, and actually we got the anticipated results clinically with supported cephalometric findings.

Table 1: Cephalometric changes in a female patient aged 7 years treated with the chin cup appliance

Parameters	*Pretreatment*	*Post-treatment*
1. Maxillary skeletal		
a. SNA	74°	77.7°
b. NI to A	–11.7 mm	– 7.3 mm
c. Max. length	77.4 mm	80.4 mm
2. Maxillary dental		
a. U Inc. to SN	105°	114°
b. U Inc. to NA (mm)	7.2 mm	9.9 mm
3. Mandibular skeletal		
a. SNB	79°	80.9°
b. Facial angle (Down's)	82.2°	83.6°
c. Mandibular length	107.4 mm	108.8 mm
d. NI to Pog	– 14.5 mm	– 8.5 mm
4. Mandibular dental		
a. IMPA	101.3°	96.9°
b. L Inc. to NB (mm)	6.3 mm	3.1 mm
5. Vertical		
a. Y-axis	61°	67°
b. Index post/ant	66.30%	69.80%
c. LAFH	54.5 mm	56.3 mm
6. Soft tissue		
a. E plane to U/Lip	– 2 mm	– 2 mm
b. E plane to L/Lip	+ 2 mm	0 mm

CONCLUSION

Although individual reactions to the chin cup force are different in the effects on each growth parameter, the possibility of controlling them is not necessarily the same. From the stand point of long-term results, we should not overestimate the effects

Fig. 7: Pretreatment extraoral (case 2)

Fig. 8: Pretreatment intraoral (case 2)

Fig. 9: With chin cup (case 2)

Fig. 10: Post-treatment extraoral (case 2)

Fig. 11: Post-treatment intraoral (case 2)

of a chin cup appliance to correct skeletal facial profiles. A chin cup should be applied within limitations on the basis of proper diagnosis and treatment objectives.

It is clear that further investigation is needed to gain more practical guidance for chin cup use in growing Class III malocclusions, particularly in the permanent dentition.

Table 2: Cephalometric changes in a male patient aged 10 years treated with the chin cup appliance

Parameters	*Pretreatment*	*Post-treatment*
1. Maxillary skeletal		
a. SNA	78°	79°
b. NI to A	–2 mm	–4 mm
c. Max. length	94 mm	96 mm
2. Maxillary dental		
a. U Inc. to SN	100°	108°
b. U Inc. to NA (mm)	2 mm	4 mm
3. Mandibular skeletal		
a. SNB	80°	78°
b. Facial angle (Down's)	90°	86°
c. Mandibular length	116 mm	117 mm
d. NI to Pog	0 mm	–6 mm
4. Mandibular dental		
a. IMPA	97°	86°
b. L Inc. to NB (mm)	4 mm	1 mm
5. Vertical		
a. Y-axis	55°	59°
b. Index post/ant	65.45%	64.20%
6. Soft tissue		
a. E plane to U/Lip	–2 mm	–1 mm
b. E plane to L/Lip	5 mm	3 mm

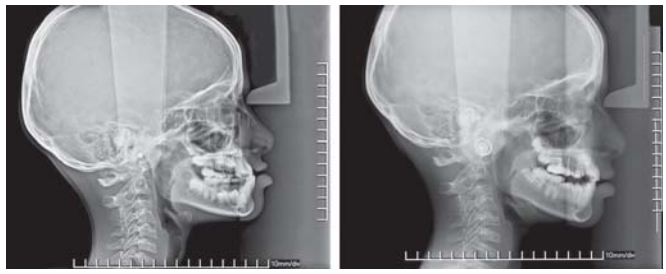

Fig. 12: Pretreatment and post-treatment lateral cephalogram (case 2)

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