



TANDEM APPLIANCE

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Orthodontic clinicians agree that Class III skeletal malocclusions are one of the most difficult malocclusions to treat. Ideally, younger patients in mixed dentition with mid face deficiencies are treated either with forward pull headgear (facemasks) or the modified fixed Tandem Appliance. My preference today is to utilize the Tandem Appliance since the rate of compliance is so much better than with the facemask.

Differential Diagnosis Class III Skeletal Malocclusion

1. Retrognathic (underdeveloped) Maxilla
Normal Mandible
Treatment: Modified Tandem Appliance
Forward pull head gear (facemask)
80% cases in mixed dentition
2. Normal Maxilla (anterio-posteriorly)
Prognathic Mandible
Treatment: Delay treatment until majority of growth completed
Orthognathic surgery to move mandible posteriorly, age 17-19.
20% cases in mixed dentition.

Two significant long term surgical side effects include:

1. Damage to nerves sometimes causing parathesia
2. The retraction of the mandible with the resulting retraction of the tongue can often reduce the size of the pharyngeal airway which increases the incidence and seriousness of life threatening obstructive sleep apnea in certain individuals. (higher incidence in patients who are overweight or obese later on in life).

Obviously the treatment choice would be to treat the developing Class III malocclusion, midface deficiency as early as possible. Successful early treatment of this disfiguring malocclusion will also help prevent future psychological problems that these children may have to endure.

I have personally found that parents of these children with midface deficiencies are extremely anxious to proceed with treatment at an early age in an effort to try and avoid surgical correction at a later date. Is it preferable to have the child wear a Tandem Appliance for 7-9 months in the mixed

dentition rather than have orthognathic surgery and 2 to 3 years of orthodontic treatment at age 17-19. Proffitt stated that the optimal age for maxillary protraction is age 6-7.¹ At that time he recommended the protraction facemask. Sullivan recommended treatment before age 10 or at least 1-2 years before the pubertal growth spurt.²

Causes of the Class III Skeletal Malocclusion

1. Hereditary: It is prudent to always check with patient's parents and relatives regarding the incidence of skeletal Class III malocclusions. Etiology is certainly partially due to genetics.³
2. Environmental factors that contribute to skeletal Class III malocclusions: These factors include enlarged tonsils, difficulty nasal breathing, disease of pituitary glands, habit of protruding the mandible, irregular eruption of the incisors.⁴ Mouthbreathing and insufficient nasal respiration can significantly affect facial growth contributing to maxillary deficiency and excess vertical growth.^{5,6,7}

Prevalence Class III Skeletal Malocclusions

Class III skeletal malocclusion occur in about 5% of the population in North America but are more prevalent in East Asian countries due to the higher number of midface deficiencies.⁸ The incidence in the Chinese and Japanese population is approximately 14%.⁹

Class III malocclusions are one of the most difficult to correct. Incidence in Caucasian population 1-5% (Massler and Frankel, 1951; Haynes, 1970; Thilander and Myberg, 1973). Chinese and Japanese 14%. (Allwright and Burndred, 1964; Irie and Nakamura, 1975; Iwagaki, 1983) Majority of subjects with Class III skeletal malocclusions have maxillary retrusion or hypoplasia in combination with normal or minimally prognathic mandible. (Mayor and El-Bradraway, 1993).

Early orthopedic treatment of Class III skeletal malocclusion is a better alternative to later surgical intervention (Kapust et al, 1998). The use of the chin cup treatment has long been abandoned because of poor long term results (Mitani and Fukazawa, 1986; Sugawara et al., 1990; Üner et al., 1995).

Ideal treatment time is primary mixed or late mixed dentition. Reduction in total treatment time achieved when patients treated at a younger age.

Reverse face mask is also effective in treating Class III malocclusions.¹⁰

Different Types Class III Malocclusions

1. Skeletal Class III
80% deficient maxilla, normal mandible
Treatment; Tandem Appliance
20% normal maxilla, prognathic mandible
Treatment; Orthognathic surgery to move mandible posteriorly
2. Dental Class III
Anterior crossbite. Disharmony of inclination of incisors. Maxillary incisors lingually inclined. Class I skeletal.
Treatment: Removable Anterior Sagittal to procline upper central incisors.
3. Functional Class III
When patient closes in centric occlusion the mandible shifts forward into what appears to be a Class III skeletal relationship. Problem is usually due to retroclined or vertical maxillary incisors and sometimes proclined lower incisors. Patients with functional Class III malocclusions can bite end to end. Patients with true Class III skeletal malocclusions cannot bite end to end. Treatment: Removable Anterior Sagittal appliance to procline upper incisors.

To correct the anterior crossbite in the case of the dental Class III or functional Class III it will be necessary to open

the vertical either with posterior occlusal acrylic pads on the Anterior Sagittal appliance or composite buildups on the lower primary molars.

Horizontal Grower

The Tandem Appliance is indicated primarily for patients with a horizontal growth pattern, deep overbite, anterior crossbite, and short or normal lower face height. With the fixed Tandem Appliance the bite is usually opened either with acrylic pads on the lower part or preferably with composite buildups on the lower primary molars. This opens the bite in order to correct the anterior crossbite and rotates the mandible downward and backward. The posterior movement of the mandible with the increase in vertical and the anterior movement of the maxilla using the Tandem Appliance helps to correct the skeletal Class III malocclusion.

Vertical Grower

The Tandem is contra-indicated for patients with vertical growth patterns and anterior open bites.

Temporomandibular Dysfunction contra-indication for Tandem Appliance

Class III elastics which are worn during the daytime and at night have a tendency to move the condyles up and back. Patients with TM dysfunction and internal derangements which include clicking and intermittent locking cannot wear Class III elastics. Therefore, clinicians are urged to diagnose the presence or absence of TM dysfunction prior to treatment. Recommended diagnostic procedures would include, TMJ Health Questionnaire, Range of Motion, Muscle Palpations and Joint Vibration Analysis, (BioResearch).



**Male age 5
Class III Skeletal
Deficient Maxilla
Normal Mandible
Prominent Lower Lip**



Class III Cuspid - Class III Molar



Anterior Crossbite - Deep Overbite



Upper Part Tandem: Hyrax Screw

- Bands Second Primary Molars
- Mesial Rests First Primary Molars
- Buccal Arms
- Hooks Class III Elastics Nighttime



Lower Part Tandem: Acrylic Splint

- Buccal Tubes for Facebow
- Midline Screw
- Adam's Clasp Second Primary Molar
- C Clasps Lower Cuspids(Add Composite)



Tandem Appliance:
Fixed Hyrax Screw Buccal Arms

- Removable Acrylic Splint
- Buccal Tubes First Molars
- Facebow Night Only



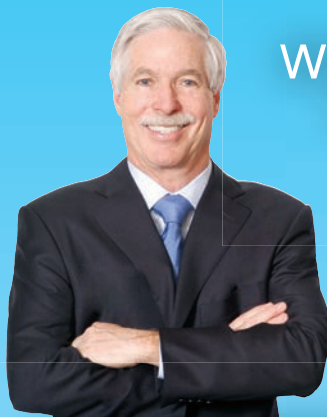
Facebow Night Only: Class III Elastics

- Rhino 1/4", 6 1/2 oz
- After 2 months,
- 2 elastics each side
- 2 Elastics Force Level 13 oz each side



Tandem Appliance

- Class III Elastics
- Facebow Nighttime



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Anterior Crossbite (Age 5)



Crossbite Corrected (Age 7)



Class III Skeletal - (Age 5)

- Class III Skeletal
- Deficient Maxilla
- Normal Mandible



Class I Skeletal

- Normal Maxilla
- Normal Mandible
- 7 Months Later



Anterior Crossbite (Age 5)



Class I Molar (Age 12)



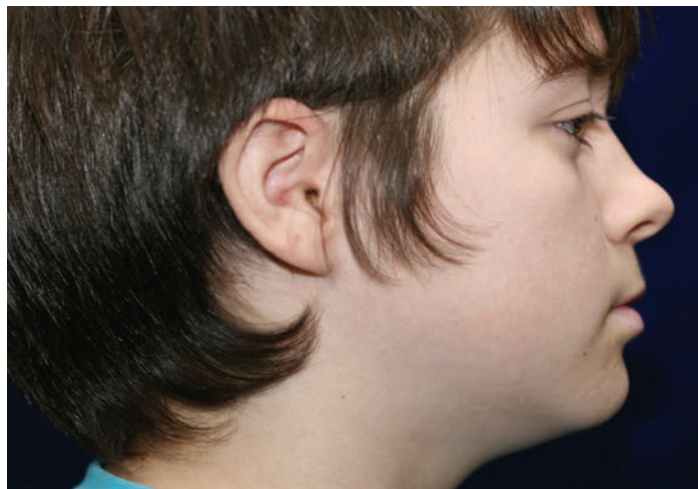
Anterior Crossbite



Overbite 3mm
Tandem Appliance Only
No Fixed Orthodontic Braces



Class III Skeletal - (Age 5)
Class III Skeletal
Deficient Maxilla



8 Years Later (Age 12)

Only Treatment Was Tandem Appliance
7 Months Treatment Age 5

Summary of Treatment Improvements with Tandem Appliance

1. Correction of the anterior crossbite.
2. When the vertical dimension is increased the mandible rotates downward and backward which helps correct the Class III skeletal malocclusions.
3. The backward movement of the mandible drastically improves the profile.
4. Increases the fullness in the upper lip due to the protraction of the maxilla.
5. Patient acceptance of the intra oral Tandem Appliance is much higher than with extra oral facemask.
6. B point moved backward.
7. A point moved forward.
8. Psychological improvement in children's self-esteem.
9. Corrects the malocclusion in a transverse, sagittal and vertical dimension.
10. Early correction of the Class III skeletal deformity can drastically reduce the orthodontic treatment time in fixed braces.
11. Correction of the midface deficiency and the establishment of an overbite will hopefully restrict the forward movement of the mandible and eliminate the need for orthognathic surgery at a later date.
12. Positive overjet and positive overbite to help maintain anterior occlusion. To help achieve an overbite remove the composite buildups on the lower primary molars after the maxilla has been protracted.

Tandem vs. Facemask

The traditional facemask protrudes the maxilla with pure extra oral anchorage with minimal dentoalveolar changes. The Tandem is an intra oral tooth borne anchorage system that combines skeletal and dentoalveolar movement.¹¹

Patients prefer the intraoral Tandem Appliance compared to the facemask which frightens some patients due to its physical appearance and bulkiness which frequently causes skin irritation from the anchorage pads on the chin and forehead.

Important Factors re Tandem Appliance

1. The design of the buccal arms on the upper part of the Tandem and the hooks on the lower facebow are important to the effectiveness of the Tandem Appliance. The Class III elastic force which is worn at nighttime passes through the centre of resistance of the maxilla 20° downward to the occlusal plane.¹² Therefore the buccal arms ideally should be bent downwards at 20°.
2. Mobilization of the maxillary suture system has become an integral part of the orthopedic correction of the skeletal Class III malocclusion. The expansion of the maxilla disrupts the circummaxillary suture system presumably facilitating the response of the protraction of the maxilla.¹³ Therefore the upper part of the Tandem should have a midline hyrax screw which should be activated for 1-2 months prior to the application of the Class III elastics.

Overcorrection Class III Skeletal Malocclusion

Due to the fact that the mandible grows forward more rapidly than the maxilla in mixed dentition it is necessary to overcorrect to ensure long term stability.¹⁴

In retention you could consider one of the two possible options until the pubertal growth spurt.

- a. Reverse Twin Block (Class III Twin Block) could be worn at night to try and restrict the forward movement of the mandible.
- b. Class III Silent Nite Appliance similarly restricts the forward movement of the mandible.

Both of these appliances move the mandible backwards when the patient opens their mouth.

Conclusion

The treatment of Class III skeletal malocclusions with mid face deficiencies can be extremely rewarding. Clinicians need to be aware that if early orthopedic treatment is not initiated then there is a much greater chance that the patient will need to have orthognathic surgery at age 17-19 including 2 years of orthodontic braces. If the patient presents with an underdeveloped maxilla and the Tandem Appliance successfully moves it forward to the ideal position then it will never be necessary to surgically move it at a later date. Maxillary advancement surgery is the most dangerous surgery compared to mandibular surgery. I would urge all orthodontic clinicians to consider adding the Tandem Appliance to help treat their younger patients with midface deficiencies and Class III skeletal malocclusions.

The increased level of cooperation, combined with the ability to protract the maxilla makes the Tandem Appliance an important appliance to treat children in early mixed dentition with Class III skeletal malocclusions.

Your patient and parents will be very grateful and you will find your orthodontic practice more rewarding.

Tribute to Dr. Leon Klempner

This article would not be complete if I did not acknowledge the fact that my good friend and orthodontic colleague, Dr. Leon Klempner, introduced me to the Tandem Appliance at my annual advanced orthodontic meeting in Las Vegas approximately 10 years ago. This Tandem Appliance has benefited countless numbers of patients and many parents and patients expressed to me how grateful they are at having had this treatment which avoided orthognathic surgery.



Many thanks again Leon for your outstanding contribution to the orthodontic profession. Especially for the Tandem Appliance which is so effective in treating Class III malocclusions in the mixed dentition. So

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Brock Rondeau, DDS is a Diplomate of the International Board of Orthodontics, Diplomate American Board of Craniofacial Pain, Diplomate Academy of Clinical Sleep Disorders Disciplines, Master Senior Certified Instructor for the International Association for

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