The Dilemma of Class III Treatment

Early or Late?

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A clinical study of the results of various types of early Class III treatment in 14 patients, with emphasis on the reverse-pull face crib. The conclusion is that the important benefits of early treatment should not be denied because of concerns that a few may still require further treatment later.

Timing of orthodontic treatment has always been somewhat controversial. Many practitioners, after some frustrating experiences with the complexities of treatment in the mixed dentition, have chosen to postpone most orthodontic treatment until all permanent teeth are present.

Extraoral anchorage and functional appliances have proven very useful in correcting Class II conditions in the growing patient, and there has been great interest in the details of their application. Unfortunately, the same enthusiasm for interceptive treatment in the developing Class III patient has not gained such popularity.

Although the treatment of Class III malocclusion has received a considerable amount of attention during this century, most of this treatment has been focused on a combined orthodontic/surgical correction. Even today, many Class III patients are not treated until the orthodontist feels that active growth is complete.

A large number of clinicians feel that a developing mandibular prognathism will reach a predetermined genetic potential that cannot be altered by earlier treatment. This approach to Class III correction predetermines that many young people must experience facial and dental disfigurements which could have far-reaching physical and psychological ramifications during some of the most important formative years of their lives.

The purpose here is to emphasize the need for early diagnosis and possible treatment for these Class III malocclusions and their associated facial patterns. Case histories of several Class III patients selected from the author's practice are presented. Different methods of treatment are evaluated. One solution to the dilemma of whether or not to attempt early interception of Class III malocclusions is proposed.

Review of the Literature

Early interception of Class III malocclusion has been advocated for many years. Angle ('07) suggested that: "Deformities under this class begin at about the age of the eruption of the first permanent molars, or even much earlier, and are always associated at this age with enlarged tonsils and the habit of protruding the mandible, the latter probably affording relief in breathing. . . .

"So, inharmony being once established, it usually progresses rapidly, only a few years being necessary to develop by far the worst type of deformities the orthodontist is called on to treat, and when they have progressed until the age of 16 or 18, or after the jaws have become developed in accordance with the malpositions of the teeth, the patient has usually passed beyond the boundaries of malocclusion only, and into the realm of bone deformities, for which, with our present knowledge, there is little possibility of affording relief through orthodontic operations. . . .

"It is the author's belief that if the throat could be properly treated, and the first molars at the time of their eruption mechanically assisted into normal occlusion and there compelled to remain by delicate yet efficient retention for a few months, these unsightly deformities would rarely, if ever, develop."

Angle further boldly proposed: "The time-honored custom of attributing these conditions to heredity and degeneracy, still made prominent in the latest books on orthodontia has, in the author's opinion, no substantial support."

Angle was also one of the first to suggest that a combined orthodontic and surgical approach was the only way to correct true mandibular prognathism, once fully developed.

Tweed ('66) divided Class III malocclusions into a category A for pseudo-Class III malocclusions with normally shaped mandibles and underdeveloped maxillae, and a category B for skeletal Class III malocclusions with large mandibles.

In reference to his category A malocclusions, Tweed stated: "These individuals should be treated during the mixed dentition stage of growth (7 to 9 years of age). If the malocclusion occurs in the primary dentition, it should be treated as early as 4 years of age. A multiple band technique applied to the maxillary denture is preferable to the chin strap. If these children are not treated at an early age, the lingual locking of the maxillary incisors will retard growth in the maxilla and accelerate growth in

the mandible. If this condition remains untreated throughout the entire growth period, it can, and often does, result in a severe facial deformity."

In reference to category B, Tweed said: "If the condition is pronounced and the patient is 14 years of age or older, it is, perhaps, best not to attempt to treat them orthodontically. Such treatment should be postponed until growth has been consummated, at which time it is safe to resort to surgery without fear of damage to growth centers." . . . "The orthodontist is indeed fortunate, who does not have to retreat these patients one or more times. The size of the orthodontist's heart and his inherent decency has much to do with the success or failure of such treatment."

Salzmann ('66) suggests: "Treatment in Class III malocclusion should be instituted as soon as the abnormality is diagnosed." He suggested a chin cup to influence the vector of mandibular growth.

Graber ('66) advocates: "Since Class III malocclusions are among the most difficult to treat by the specialist and since surgical intervention is contemplated more frequently for this type of problem than any other malocclusion, it just makes good common sense that at least a chin cup should be tried early to intercept the developing malocclusion and basal malrelationship." He further suggests that extraoral force as an interceptive or at least palliative procedure may serve to prevent a worsening malocclusion, at the very least.

Graber ('69) states: "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." He further states: "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. The question of whether a patient has false or real Class III malocclusion is not important. Therapy will eliminate the malrelationship, in any event. It has been my experience that many so-called 'pseudo' Class III's are full-blown Class III's later on during the prolific growth period."

According to Turpin ('81), most investigators place the incidence of Class III malocclusion at 1 to 2 percent of the population with Japanese and Scandinavian populations being somewhat higher. Jacobson ('74) and associates, in a summary of such studies, show a range from 1 percent to 12.2 percent but most studies reflect an incidence below the 5 percent level.

Turpin ('81) discussed the complexity of the skeletal relationships needed to produce a Class III malocclusion and listed large or protrusive mandible, deficient or retrusive maxilla, protrusive mandible and retrusive maxilla, protrusive mandibular dentition and retrusive maxillary dentition.

He further discussed the importance of genetics as a major influence in determining the occurrence of mandibular prognathism and alluded to the Hapsburg family with 33 of 40 family members having some degree of prognathism. He also discussed some common characteristics of Class III patients, including asymmetry, anterior crossbite with a functional shift as well as posterior crossbite.

Bell, Profitt and White ('80) stated that in most patients with skeletal Class III malocclusions, there is some degree of maxillary deficiency in ad-

dition to the more obvious mandibular excess.

They further suggested that although most Class III patients have excess mandibular development, the component of maxillary deficiency is strong enough in at least 30 to 40 percent to make it a significant part of the problem. They also felt that although some maxillary protraction may be achieved with interceptive reverse-pull mechanics, significant downward repositioning of the chin and forward repositioning of the maxillary teeth likewise occurred. They concluded that although some forward repositioning of the maxilla can be achieved by orthopedic forces, it is not yet possible to do this without having a greater effect on the mandible than on the maxilla and expressed hope for improved appliance design to allow more downward and forward repositioning of the maxilla.

In a clinical study of 20 patients, Nanda ('80) used a modified protraction headgear to attempt to correct a maxillary deficiency. After having the patients wear the modified protraction headgear 4 to 8 months, Nanda found that the maxilla was displaced 1 to 3mm and the maxillary dentition 1 to 4mm. Further improvements were obtained during the 2 to 3 year follow-up orthodontic treatment which included a chin cup. Typical changes reported by Nanda included remodeling at Point B, lingual tipping of mandibular incisors, flaring of maxillary incisors and downward rotation of the mandible.

Chin cup therapy has been used for treatment of the Class III relationship since the latter half of the 19th century. According to Graber ('75) the early attempts with the use of the chin cup were not successful because of incomplete knowledge of mandibular and facial growth, its use on nongrowing patients, and an inadequate understanding of the forces generated by the chin cup. Graber ('77) treated 30 Class III malocclusions in patients between 5 and 8 years of age with chin cups for 3 years. His study provided strong support for the use of the orthopedic-force chin cup appliance in the clinical management of young patients with skeletal mandibular prognathism.

The obvious changes which can be effected by an extraoral force such as the chin cup is substantiated by the work of Alexander ('64) and Bunch ('61) showing the deforming action of the Milwaukee brace on the mandible and occlusion.

Vego ('76), in a study on 5 patients undergoing chin cup therapy, mentioned that the most obvious and expected change is that the lower incisors became more upright and less protrusive and the maxillary incisors became more protrusive. He concluded: "Very likely, similar changes could be achieved with an intraoral appliance and simple 'bite-jumping'."

Irie and Nakamura ('75) determined that the chin cup is effective in redirecting or reducing growth of the mandible during childhood and concluded that correction of the Class III relationship was the result of downward and backward translation of the mandible, lingual tipping of the mandibular incisors and labial tipping of the maxillary incisors.

Schulhof, Nakamura and Williamson ('77) studied 14 skeletal Class III patients and showed a significant relationship between abnormal growth and the sum of the standard deviation from the normal of 4 cephalometric "predictor measurements." They suggested that these data should give the clinician insight as to which patients

might require early orthopedic treatment (chin cup), conventional orthodontic treatment, or surgical orthodontic correction after growth is complete.

Turpin ('81) developed guidelines for deciding when to intercept Class III malocclusion. He suggested that if the patient discloses characteristics listed in the positive column, early treatment should be considered, and if any characteristics fall in the negative column, delaying treatment until condylar growth has ceased may be the better alternative:

Positive Factors

convergent facial type
A-P functional shift
symmetrical condyle growth
young, with growth remaining
mild skeletal disharmony
(A-N-B < -2)
good cooperation expected
no familial prognathism
good facial esthetics

Negative Factors

divergent facial type
no A-P shift
asymmetrical growth
growth complete
severe skeletal disharmony
(A-N-B > -2)
poor cooperation expected
familial pattern established
poor facial esthetics

He suggested that if mandibular growth is excessive, consider the use of a chin cup, or a chin cup in combination with a reverse-pull headgear —and if the maxilla is deficient, consider the need for expansion as well as anterior displacement of the maxilla. He also emphasized that parents should always be aware of the fact that surgery may be necessary at a later date, even when an initial phase of treatment may be successful.

He further states: "After evaluating the characteristics of Class III malocclusions, it is apparent that the early interception of developing prognathism is often valid. Caution is advised, however, not to undertake procedures that will compromise the need for orthognathic surgery later on if the mandible grows excessively during adolescence. Early treatment can prevent the problem from becoming more severe. It can occasionally reduce the need for surgery and it can reduce potential psychosocial problems."

The foregoing perusal of the literature reveals a definite trend toward the need for at least an attempt at early interception of developing Class III malocclusions. It is apparent also that treatment of Class III malocclusions is a humbling experience and that there is no panacea for totally solving any and all problems.

Methods and Materials

Selection of patients for the present study involved evaluation of all patients seen in the author's practice in the last 8½ years who exhibited some characteristics of developing mandibular prognathism. The primary criteria of selection were either a complete anterior crossbite or at least an end-to-end incisal relationship, and less than 12 years of age at the beginning of treatment. This age criterion assumed significant remaining growth.

Ages ranged from 7.1 to 11.7 years, with a mean of 9.9 years at the beginning of treatment. Eight females and six males were evaluated. The extraoral appliances used in these cases were a combination of the reverse-

pull chin cup and reverse-pull face crib (Fig. 1).

Patients were categorized according to the combination of treatment modalities utilized.

The first group of 10 patients all used the reverse-pull face crib shown in Fig. 1 and are all currently undergoing treatment or are in a transition period awaiting another phase of treatment. Four were treated with an all-metal palatal expansion appliance in combination with the reverse-pull face crib. Four were treated with a maxillary lingual arch in combination with the reverse-pull face crib. One was treated with palatal expansion and fixed appliances in combination with the reverse-pull face crib and one with fixed appliances and a reverse-pull face crib.

The second group of 4 patients consisted of cases completed with various treatment combinations. One was treated with a removable appliance to accomplish simple bite-jumping, followed by rapid palatal expansion. One was treated only by conventional fixed orthodontic appliances. One was treated by conventional fixed orthodontic appliances and is currently undergoing further treatment in preparation for orthognathic surgery. The last was treated in two phases, first with a lingual arch in combination with a reverse-pull chin cup and then with conventional fixed orthodontic appliances.

The forces utilized with the reverse-pull face crib and reverse-pull chin cup involved a 1/4-inch, 6-ounce elastic attached from the maxillary first molar hooks to the framework of the reverse-pull appliance. The measured force was approximately 14 to 16 ounces on each side.

Patient cooperation and acceptance in the use of the reverse-pull face crib was considered excellent. The patients were instructed to use it approximately 12 hours each day, including sleeping.

Almost no discomfort was reported other than some occasional skin irritation involving the chin area. This was improved by regular changing of the padding and occasional use of medicated powders. One problem which was universal with the older design reverse-pull chin cup was a transient irritation of the palatal papillae and gingival tissues adjacent to the mandibular incisors.

The summary of skeletal and dental changes was based on cephalometric measurements and clinical observations of 14 patients. The majority of the patients are currently undergoing treatment, with the comprehensive therapy accomplished by various combinations of treatment modalities. Because the patient sample was necessarily small because of the low incidence of these problems, skeletal and dental changes were not evaluated statistically. In a clinical study such as this, average numbers and other figures for changes in dental, skeletal, and facial measurements would have little meaning.

Case Reports

Cephalometric values for all cases before and after treatment are shown in Table 1. Additional information and comments on each follow below.

Case 1, S.C.

The patient was a male, 7.1 years of age when first seen. He presented with a Class III molar relationship, an anterior crossbite and a unilateral posterior crossbite on the right side.

After 7 months of treatment with an all-metal palatal expansion appliance and a reverse-pull face crib, the crossbites were completely corrected.

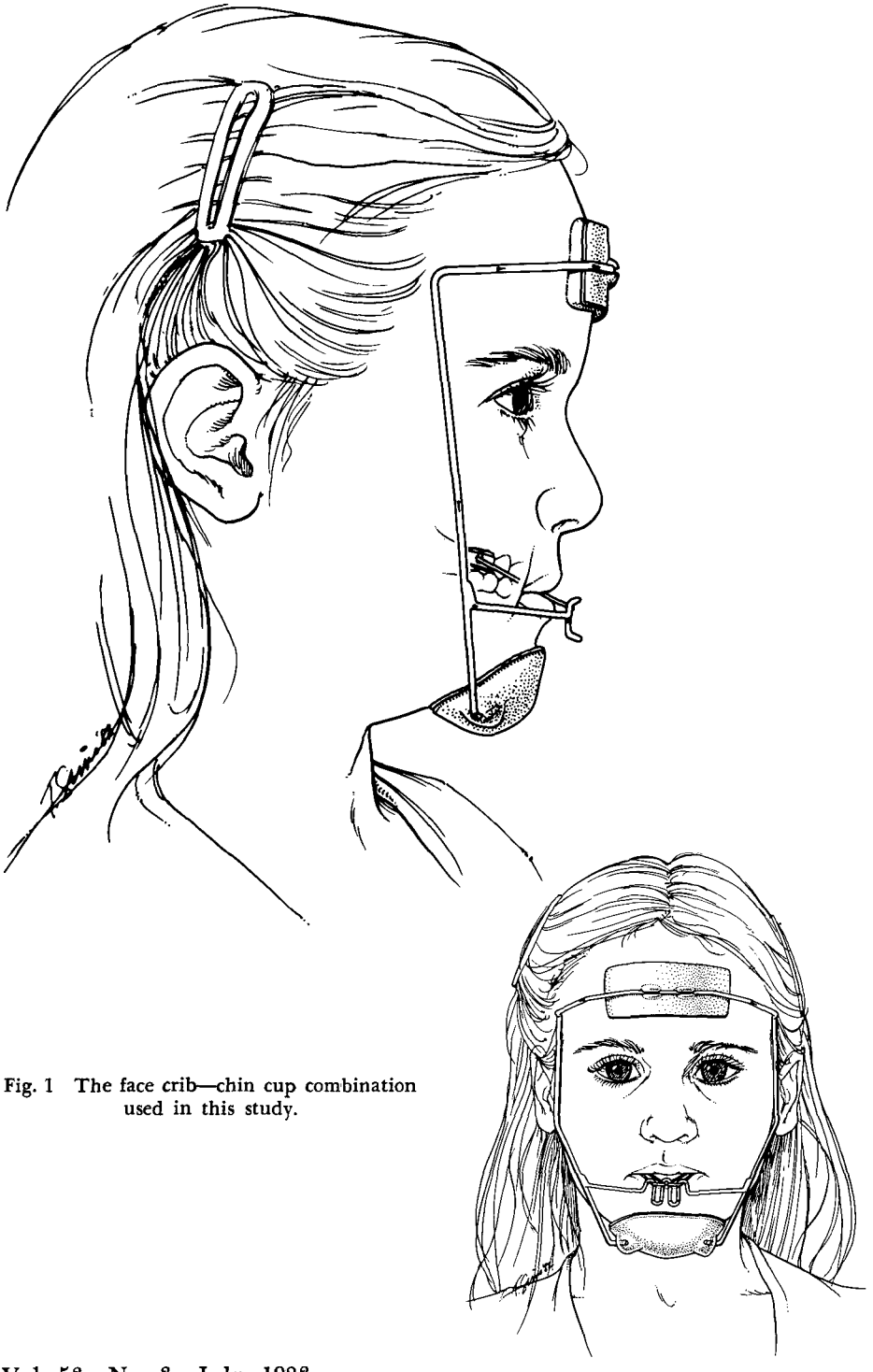

Fig. 1 The face crib—chin cup combination used in this study.

TABLE 1

	Age (years-months)		*S-N-A (degrees)*		*S-N-B (degrees)*		*A-N-B (degrees)*	
Reserve-pull face crib and palatal expansion	Initial	Progress	I	Px	I	Px	I	Px
1) S. C.	7-01	9-04	76	74	77	76	−1	−2
2) J. H.	8-01	9-00	77	77	76	75	1	2
3) K. M.	9-08	10-02	82	85	83	84	−1	1
4) L. W.	10-06	11-03	82	83	83	84	−1	−1
Reverse-pull face crib and maxillary lingual arch								
5) D. B.	7-10	8-05	83	86	84	86	−1	0
6) J. P.	9-00	9-05	82	82	84	82	−2	0
7) S. H.	10-02	10-08	80	81	82	81	−2	0
8) D. H.	11-07	12-00	82	83	86	85	−4	−2
Reverse-pull crib and palatal expansion and fixed appliances								
9) M. H.	11-09	13-07	80	79	83	82	−3	−3
Reverse-pull face crib and fixed appliances								
10) S. S.	11-07	12-08	77	79	78	78	−1	1
Simple "bite-jumping" and palatal expansion								
11) L. B.	9-11	10-10	84	86	86	86	−2	0
Fixed appliances only Class III mechanics								
12) J. S.	11-09	15-03	85	92	84	87	1	5
Fixed appliances only Class III mechanics Later surgery								
13) P. S.	11-02	14-08	78	80	80	81	−2	−1
Early Interception with maxillary lingual arch and reverse headgear followed by fixed appliances and retention								
14) L. O.	9-01	9-06	79	83	80	79	−1	4

* Relative Maxillary Advancement.
** No reverse-pull therapy.

	U1 to S-N (degrees)		*IMPA (degrees)*		*FMA (degrees)*		*S-N/MP (degrees)*		*RMA* (mm)*
Reverse-pull face crib and palatal expansion	I	Px	I	Px	I	Px	I	Px	
1) S. C.	97	109	90	89	31	33	39	39	0
2) J. H.	92	104	94	90	22	21	32	31	3
3) K. M.	109	104	81	73	27	28	37	37	2
4) L. W.	105	105	88	81	21	20	32	30	3
Reverse-pull face crib and maxillary lingual arch									
5) D. B.	116	121	90	82	24	25	30	27	3
6) J. P.	107	120	95	86	21	24	26	29	0
7) S. H.	117	119	90	86	24	24	31	33	1
8) D. H.	111	124	95	88	17	15	20	21	0
Reverse-pull crib and palatal expansion and fixed appliances									
9) M. H.	108	111	83	78	23	19	31	31	0
Reserve-pull face crib and fixed appliances									
10) S. S.	98	113	91	83	28	27	38	36	4
Simple "bite-jumping" and palatal expansion									
11) L. B.	103	118	94	87	17	19	22	23	**
Fixed appliances only Class III mechanics									
12) J. S.	106	112	93	91	26	24	34	30	**
Fixed appliances only Class III mechanics Later surgery									
13) P. S.	111	112	92	82	28	26	36	36	**
Early Interception with maxillary lingual arch and reverse headgear followed by fixed appliances and retention									
14) L. O.	102	104	90	79	24	28	35	38	2

The upper incisor to S-N angle had increased 12°, IMPA decreased 1°, FMA increased 2°, and the S-N/MP angle remained constant.

Superimposition of pre- and post-treatment (progress) cephalometric radiographs on S-N registered at S showed no measurable protraction of the maxilla.

Approximately 1.5 years has elapsed since this first phase of treatment was discontinued, and the balance of comprehensive treatment should follow later.

Case 2, J.H.

This male presented at 8.1 years with a Class I molar relationship combined with a complete anterior crossbite and bilateral posterior crossbites.

After 6 months of treatment with an all-metal palatal expansion appliance and a reverse-pull face crib, the crossbites were completely corrected. The A-N-B difference increased 1°, upper incisor to S-N angle increased 12°, IMPA increased 4°, FMA decreased 1° and the S-N/MP angle decreased 1°.

Superimposition of the pre- and post-treatment (progress) cephalometric radiograph on S-N registered at S showed maxillary protraction or growth of approximately 3mm.

The patient has not had any treatment for approximately 6 months at this time, and his development will be followed on a semi-annual basis to determine the need for additional correction.

Case 3, K.M.

This patient was a female already 9.7 years of age, with a Class III molar relationship, bilateral posterior crossbites and an end-on anterior bite.

The crossbites were corrected after 3½ months of treatment with an all-metal palatal expansion appliance and a reverse-pull face crib. The A-N-B difference changed 2° in a positive direction, upper incisor to S-N angle decreased 5°, IMPA decreased 8°, FMA increased 1°, and the S-N/MP angle remained constant.

Superimposition of the pre- and post-treatment (progress) cephalometric radiographs on S-N registered at S showed maxillary protraction or growth of approximately 2mm.

The same treatment is continuing at this time for an anticipated 3 to 6 more months.

Case 4, L.W.

This patient was a female 10.5 years old, with a Class III molar relationship and a left posterior crossbite. The anterior relationship was edge-to-edge.

She was treated with an all-metal palatal expansion appliance in conjunction with a reverse-pull face crib for 8 months. The crossbites were corrected, the A-N-B difference and upper incisor to S-N angle remained the same, IMPA decreased 7°, FMA decreased 1°, and the S-N/MP angle decreased 2°.

Superimposition of the pre- and post-treatment (progress) cephalometric radiographs on S-N registered at S revealed maxillary protraction or growth of approximately 3 mm.

Full-banded orthodontic treatment with fixed appliances will be initiated within a few months.

Case 5, D.B.

D. B. was a female 7.8 years of age. She presented with a Class III molar relationship and a complete anterior crossbite. There were no posterior crossbites.

After 11 months of treatment with a maxillary lingual arch and a re-

verse-pull face crib, the crossbite was completely corrected. The A-N-B difference increased positively by 1°, the angle of the upper incisor to S-N increased 5°, IMPA decreased 8°, FMA increased 1° and S-N/MP decreased by 3°.

Superimposition of pre- and post-treatment (progress) cephalometric radiographs along S-N registered at S showed 3mm of maxillary protraction or growth.

The patient has been out of treatment for approximately 8 months and the need for additional treatment will be monitored semi-annually.

Case 6, J.P.

This 9 year-old presented with a Class I molar relationship and complete anterior crossbite. There were no posterior crossbites.

The anterior crossbite was completely corrected after 8 months of treatment with a maxillary lingual arch and a reverse-pull face crib. There was a 2° positive change in the A-N-B difference, the upper incisor angulation to S-N increased 13°, IMPA decreased 9°, FMA increased 3°, and the S-N/MP angle increased by 3°.

Superimposition of the pre- and post-treatment (progress) cephalometric radiographs along S-N registered at S showed no maxillary advancement, but some mandibular rotation.

This patient is continuing treatment at the present time and the need for additional treatment will be evaluated at the proper time.

Case 7, S.H.

This patient was a female 10.2 years of age, with a Class III molar relationship and complete anterior crossbite. There were no posterior crossbites. The maxillary lateral incisors were congenitally missing. After approximately 5 months of treatment with a maxillary lingual arch and a reverse-pull face crib, the anterior crossbite was completely corrected. The A-N-B difference increased positively 2°, upper incisor to S-N increased 2°, IMPA decreased 4°, the FMA remained constant and the S-N/MP angle increased by 2°.

Superimposition of the pre- and post-treatment (progress) cephalometric radiographs along S-N registered at S showed approximately 1mm of maxillary advancement or growth.

The next stage of treatment will be initiated in the near future.

Case 8, D.H.

D. H. was a female 11.6 years of age. She presented with a Class III molar relationship and a complete crossbite involving the entire maxillary dentition. Her problem was complicated by the fact that 5 bicuspids were congenitally missing.

After 3 months of treatment with a maxillary lingual arch, a reverse-pull face crib and mandibular fixed appliances, the crossbites were completely corrected. The A-N-B difference increased by +2°, upper incisor to S-N increased 13°, IMPA decreased 7°, FMA decreased 2° and the S-N/MP angle increased 1°.

Superimposition of the pre- and post-treatment (progress) cephalometric radiographs along S-N registered at S showed no apparent maxillary advancement, but some mandibular rotation.

The patient is now in complete fixed appliances in conjunction with continuation of the reverse-pull face crib.

Case 9, M.H.

This 11.8 year-old presented with a

Class III molar relationship, a unilateral posterior crossbite involving the right buccal segment, and end-on anterior bite.

Treatment began with an all-metal palatal expansion appliance, a reverse-pull face crib and fixed appliances on the mandibular arch. The maxillary second bicuspids and mandibular first bicuspids had been removed. After about 5 months the palatal expansion appliance was removed and fixed maxillary appliances placed. The reverse-pull face crib was continued and is continuing at the present time.

At this point in treatment, the A-N-B difference has remained constant, the upper incisor to S-N angle has increased 3°, IMPA decreased by 5°, FMA decreased by 4° and the S-N/MP angle remained constant.

Superimposition of the pre- and post-treatment (progress) cephalometric radiographs along S-N registered at S revealed no measurable change in the basal relationships.

Treatment is continuing.

Case 10, S.S.

S. S., was a male 11.6 years of age, with a Class II molar relationship apparently related to congenitally missing maixllary second bicuspids and ectopic eruption of the maxillary first molars. There was a complete anterior crossbite.

Treatment involved partial banding of the maxillary arch with a reverse-pull face crib for approximately 7 months.

The following changes were noted: The A-N-B difference increased positively by 2°, upper incisor to S-N angle increased by 15°, IMPA decreased by 8°, FMA decreased by 1° and the S-N/MP angle decreased 2°.

Superimposition of the pre- and post-treatment (progress) cephalometric radiographs along S-N registered at S revealed approximately 4mm of maxillary protraction or growth.

Treatment is continuing and full appliances will be placed soon.

Case 11, L.B.

This patient was a female 9.9 years of age with a Class III molar relationship, a unilateral posterior crossbite involving the right buccal segment, and a complete anterior crossbite.

Treatment involved a simple removable appliance with finger springs and bite-opener designed to "jump" the anterior crossbite. The anterior crossbite was corrected in approximately 2 months. Because the patient lived a long distance away, the posterior crossbite was not corrected until a year later. An all-metal palatal expansion appliance was then used to correct the posterior crossbite. Cephalometric evaluation approximately a year after the anterior crossbite correction showed a positive 2° increase in the A-N-B difference, upper incisor to S-N angle increased 15°, IMPA decreased 7°, FMA increased 2°, and the S-N/MP angle increased 1°.

Superimposition of cephalometric radiographs before and after anterior crossbite correction showed approximately 2mm of maxillary growth or advancement and some mandibular rotation.

This patient has been followed for approximately 8 years, but no further treatment has been done by family choice.

Case 12, J.S.

J. S., was a male 11.8 years of age with a Class II molar relationship related to ectopic eruption of the maxillary first molars, and a complete anterior crossbite.

Treatment was with a conventional

.022 × .028 edgewise appliance and Class III mechanics following extraction of all second bicuspids.

Posttreatment records revealed an acceptable occlusion and an A-N-B difference increased 4°, upper incisor to S-N angle increased 6°, IMPA decreased 2°, FMA decreased 2° and S-N/MP angle decreased 4°.

Superimposition revealed significant growth changes.

This patient has held well for the last 4 years without retention.

Case 13, P.S.

This patient was a male 11.2 years of age, with a Class III molar relationship and a complete anterior crossbite.

Treatment was accomplished with a conventional .022 × .028 edgewise appliance and Class III mechanics following extraction of all first bicuspids.

Posttreatment records revealed an acceptable occlusion and the following cephalometric changes: the A-N-B difference increased positively 1°, the upper incisor to S-N angle increased 1°, IMPA decreased 10°, FMA decreased 2°, and the S-N/MP angle decreased 1°.

Superimposition revealed significant growth changes. Approximately 2 years into retention, it became obvious that relapse was inevitable.

The patient is now 20 years of age and further treatment has begun, with surgical correction planned as soon as arch alignment is completed.

Case 14, L.O.

This patient is a female who presented at 9.1 years of age with a Class III molar relationship and a complete anterior crossbite. The maxillary lateral incisors were congenitally missing.

She was first treated for about 5 months with a maxillary lingual arch and a reverse-pull chin cup, which corrected the anterior crossbite. Then the mandibular first bicuspids were removed, and full fixed appliances used to complete the correction.

The A-N-B difference increased 5° positively, upper incisor to S-N angle increased by 2°, IMPA decreased 11°, the FMA increased by 4°, and the S-N/MP angle increased 3°.

Superimposition of the pre- and posttreatment cephalometric radiographs for the first phase along the line S-N registered at S revealed maxillary protraction or growth of approximately 2mm, with some mandibular rotation. Almost 2 years had elapsed between completion of the crossbite correction and initiation of the final phase.

The patient is now 17 years old and is continuing in retention.

Results

Although it is most difficult to generalize concerning results with this type of clinical study, there are a few areas where comparisons can be made. Because each patient in the study is totally different in heredity, etiology of malocclusion and environmental factors, these comparisons must necessarily involve treatment modalities only. A summary of these treatment methods and cephalometric measurements of the patients is shown in Table 1.

Eleven of the 14 patients evaluated in the present study were treated with some form of reverse-pull mechanics to the maxilla, using rather light forces.

Seven of the 11 patients demonstrated measurable forward displacement and/or growth of the maxilla as measured by the relation of Point A and the anterior nasal spine to the

cranial base. The amount of forward displacement and/or growth of the maxilla ranged from 1 to 4mm. It is noteworthy that in Patient 11, who had only bite-jumping and palatal expansion this change was also 2mm.

Lingual tipping of the mandibular incisors as measured by IMPA was observed in all 14 patients. Labial tipping of the maxillary incisors as measured by upper incisor to S-N was evident in 12 of the 14 patients. Cases 3 and 4, who experienced no labial tipping, had palatal expansion only, with no labial or lingual forces to the maxillary incisors.

There was some mesial movement of the maxillary first molars in all but one of the 11 patients using reverse-pull mechanics. This movement ranged from 0.5 to 3mm.

Mandibular rotation as measured by opening of the FMA was observed in 6 of the 14 patients. This same change as measured by opening of the S-N/MP angle was observed in 5 of the 14 patients.

Changes in the A-N-B difference toward a more positive number were observed in 11 of 14 patients. In 2 patients it remained constant, and in one case it showed a 1° decrease toward a more negative number. It was interesting to note that some maxillary teeth were congenitally missing in 4 of the 14 patients. This suggests a possible etiologic relationship among anodontia, underdevelopment of the alveolar bone and development of Class III.

Treatment was completed in the last 4 patients.

Case 11 showed some interesting changes with only palatal expansion and bite-jumping. The remodeling at Point A was significant, as was the expected tipping of the incisors.

Case 12 showed phenomenal growth with routine response to full treatment.

Case 13 exhibited expected growth until 2 years after treatment, when unilateral mandibular growth contributed to relapse and an anterior crossbite which necessitated further treatment involving surgical intervention.

Case 14 represents achievement of all of the goals of early interceptive treatment, with apparently stable finished results. However, even at an age of 17 years, approximately 8 years after beginning treatment, this patient cannot be considered unequivocably free of complications.

Discussion

Based on data presented in the present investigation, it is apparent that early interception of Class III malocclusions should be included in the contemporary orthodontic practitioner's armamentarium. It is likewise obvious that correction of this complex problem must necessarily be a long-term procedure.

Because most Class III patients present with some maxillary deficiency as well as possible mandibular excess, mechanics applied early to protract the maxillary structures and apply reciprocal retractive forces to the mandible appear to have significant validity.

The reverse-pull face crib (RPFC) (Fig. 1), in combination with the necessary fixed appliances, provides such a force system. This appliance is comfortable and readily accepted by most patients. The RPFC does not require occipital pull and therefore alleviates objections involving hair styles. It is held in place by elastics, and presents no problems with the patient's sleeping patterns.

Although several investigators have

claimed definite orthopedic advancement of the maxilla with reverse-pull mechanics, the proof of such movement is somewhat questionable. The present data confirm the same response in several patients, as observed by other authors using these forces, but this was also observed in the patient who had only bite-jumping and palatal expansion.

This author prefers to use the term "Relative Maxillary Advancement" in describing these anteroposterior changes in response to reverse-pull mechanics and anterior crossbite correction. Relative maxillary advancement may be defined as the effective therapeutic change in the anteroposterior relationships among maxilla, cranial base and mandible. Relative maxillary advancement appears to be achieved in certain growing patients by a combination of factors:

1. Stimulation of anterior growth of the maxilla at its sutural articulations
2. Bone remodeling at both points A and B
3. Labial tipping of the maxillary incisors
4. Lingual tipping of the mandibular incisors
5. Posterior positioning of the mandible if functional forward positioning is present
6. Mandibular rotation
7. Changes in growth vectors resulting from the normalized functional environment.

It should be pointed out that relative maxillary advancement may occur with any combination of the above factors. Even though many of these factors may be present, relative maxillary advancement still does not occur in every patient.

Even in patients with no measurable relative maxillary advancement, anteroposterior changes in incisor inclination or mandibular position can provide desirable changes in allowing for a more normal environment for growth of the maxilla and restriction of growth of the mandible.

A thorough evaluation of the patient reports presented in this study emphasizes the importance of early interceptive procedures in Class III malocclusions. Based on the fact that maxillary deficiency is such an important part of the malocclusion, it appears that the use of reverse-pull mechanics is a valid approach in a majority of patients.

Although most of the patients undergoing RPFC treatment are far from finished because of the extended care that is always necessary, their chance for arriving at an acceptable result appears better than if early treatment had not been attempted. In retrospect, the author would like to have also seen the added effects of reverse-pull mechanics in Cases 11 and 13.

Case 14 does demonstrate a finished result in which all described forces were utilized. The likely effects of the alternate course of waiting for growth to run its course without the benefits of early intervention seen here are obvious.

Treatment timing with early interceptive Class III treatment is most important. Obviously, these patients need to be seen at the earliest possible date in order to plan for the future. Ideally, the author prefers to do no treatment until the maxillary first molars, central and lateral incisors are present.

The suggested early treatment of choice in all Class III patients is the use of the reverse-pull face crib

(RPFC) in combination with appropriate fixed appliances.

When posterior crossbite is present, or if the width of the maxilla is even slightly deficient, a palatal expansion appliance is used in combination with the RPFC. If no lateral deficiency exists, a simple fixed maxillary lingual arch, with the lingual wire in contact with the cingula of the maxillary incisors, is used in conjunction with the RPFC.

Anterior brackets or bands are seldom used in combination with the RPFC due to the obvious problem of shearing forces of occlusion.

Treatment time varies with the individual patient, but the RPFC is generally used *at least 6 to 12 months.* It may be used periodically throughout the growing years.

The goals of early treatment of Class III malocclusions should be to:

1. Help provide a more favorable environment for normal growth
2. Achieve as much relative maxillary advancement as possible
3. Improve occlusal relationships
4. Improve facial esthetics for more normal psychosocial development.

The present investigation suggests that all Class III malocclusions could benefit from an early interceptive regimen. Even though there is no question that some severe skeletal dysplasias will require surgical correction at a later time, an attempt should still be made to at least improve the problem.

When a sincere attempt at early interception has been made, and surgery is still necessary, the clinician can feel morally certain that everything possible has been done. Hindsight for lost opportunities, on the other hand, is of no value to such a patient.

Summary

The validity of early interception of Class III malocclusion was evaluated as a possible alternative to later surgical intervention. Some improvement was achieved in all patients, although ultimately surgery may still be needed in some.

Fourteen growing patients were studied and evaluated cephalometrically. Eleven of the 14 patients used some form of reverse-pull mechanics to the maxilla in conjunction with a variety of fixed appliances. One was treated with a removable bite-jumping appliance followed by palatal expansion.

One patient is currently undergoing further treatment which will involve surgical intervention.

The following phenomena were observed following reverse-pull mechanics:

1. Relative maxillary advancement
2. Mandibular rotation
3. Labial tipping of the maxillary incisors
4. Lingual tipping of the mandibular incisors
5. Mesial movement of the maxillary molars
6. Changes in A-N-B differences toward a more positive value.

The reverse-pull face crib (RPFC) in combination with either a fixed palatal expansion appliance or fixed maxillary lingual arch is proposed as the treatment method of choice for early interception of Class III malocclusion.

Treatment should begin as soon as the maxillary central and lateral in-

cisors and maxillary first molars are completely erupted.

Goals of early interception of Class III malocclusions are:

1. To help provide a more favorable environment for normal growth
2. To achieve as much relative maxillary advancement as possible
3. To improve occlusal relationships
4. To improve facial esthetics for more normal psychosocial development.

It is concluded that early interception of Class III malocclusion should be attempted in all patients; there should be no dilemma in reaching such a decision.

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