# Guiding the Child's Teeth with Class III Dental Malocclusion into Correct Occlusion: A Clinician's Parenting

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*Pediatric dentists are often the first ones to be consulted for the presence of an anterior cross bite in the primary dentition. The condition requires an early interception to avoid progressive dentoalveolar and skeletal changes. The management, however, poses unique challenges in terms of young age of the child, correct choice of appliance and unpredictability of the response to treatment due to inability to ascertain the inherent growth potential. It is very important therefore for the specialist, to be able to recognize the early signs of a developing class III malocclusion tendency and also know the basic details of successful management of such cases. The following article describes the appropriateness of appliance choice for a case of incisor cross bite in primary dentition using different appliances based on their varied clinical presentations.*

*Key words: Primary anterior cross bite, management options*

## INTRODUCTION

Right from birth of a child the oral cavity remains a focus of attention for the parents, initially for feeding and later, expectations of cutting the first milk tooth. In majority of the children, the primary teeth erupt in a fairly regular fashion into good occlusion. In some cases parents observe crooked teeth. With the growing awareness of malocclusion in the population and the existence of its treatment, they report at an early age, much before the eruption of permanent teeth.

Prevalence of malocclusion in primary dentition has been reported to be as high as 46.2%, which includes conditions like deep overbite (19.7%), posterior cross bite (13.1%), accentuated overjet (10.5%), anterior open bite (7.9%) and anterior cross bite (6.7%)[1]. The primary anterior dentition cross bite, though not very common with a reported prevalence of 4-13 %, in different populations [2,3], needs immediate attention, so that further growth disturbance of the maxillary and mandibular arches from an unfavorable environment is prevented. Unfortunately, sometimes the treatment/ referrals are delayed due to lack of knowledge of the treating dentist. Limited experience of pediatric dentists in treating such malocclusions and lack of child management expertise among orthodontists could further add to neglect of treatment in such cases.

Broadly, primary anterior teeth cross bites can be classified as; **Type 1: '*Functional*'**, which present with a CR-CO discrepancy due to occlusal prematurities; and **Type 2: '*True class III tendency'***, with clinical features of a developing true class III malocclusion along with cephalometric support and no CR-CO discrepancy. **Type 1** can be further classified into two types; **Type 1a: '*Simple'***, with no abnormal dentitional or dentoalveolar changes; **Type 1b: '*Complex'***, *with* abnormal dentoalveolar relation mimicking true class III. The varied clinical presentations of cross bite of both types coupled with inability to predict mandibular growth accurately and questionable patient compliance pose different challenges such as, timing of treatment (*due to possibility of self-correction*) and most suitable appliance (*out of the various appliances that may have been available*) for its management. A number of treatment methods have been reported in the literature for early correction of primary dentition incisor cross bites such as, anterior crowns[2], 2 x 4 appliance[3], composite or acrylic inclined planes,[4] removable mandibular retractor[5-7], anterior expansion appliance[8], and occlusal splints with elastics[9]; each with successful results. Nearly all the investigators in the published case reports have used and advocated a single type of appliance for management of all types of cross bites. Whether one type of treatment modality is suitable for all types of cases or one can select a specific treatment method for correction of primary dentition incisor cross bites having different clinical presentation,

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needs to be understood. We at the Oral health Sciences Centre have been practicing most of the above-mentioned treatment modalities for the varied clinical presentation of cross bite depending on specific need of the case with beneficial treatment results in contrast to only one appliance for all incisor cross bites in primary dentition. The present article aims to share a preliminary report on this aspect to aid the clinician make appropriate decisions depending upon the specific need of the case. Most of the appliances are simple and can be managed by the Pediatric Dentist, with occasional guidance of a willing orthodontist.

### *Posterior Bite Plane (For Type 1a case)*

## Case 1

A six- year old boy reported with the chief complaint of having abnormally positioned front teeth. Extraorally the child had a concave profile with cross bite evident on talking and smiling. On intra-oral examination a crossbite of primary anterior teeth was present (fig. 1a). Further examination of the cross bite showed a CR-CO discrepancy. The child was in early mixed dentition stage with erupting 31 and 41. There was no family history of such a malocclusion. Cephalometrically child showed a skeletal class III pattern which could be due to the forwardly positioned mandible. ( Table 1). Due to presence of a functional shift and normal inclination of the maxillary incisors (elaborated in the discussion), a simple disocclusion of the arches was selected as a suitable interceptive modality for correction of the cross bite. A maxillary appliance with a posterior bite plane was fabricated (fig. 1b). The child was comfortable with the appliance and it was reported as having been worn regularly on a follow-up visit. The cross bite was corrected after two months of regular wear of the appliance. The acrylic bite planes were trimmed till the occlusion completely settled. At a follow-up visit timed with eruption of permanent maxillary incisors, 11 was found to be erupting in edge-to-edge relation to the 41 (fig 1 c**)**. The appliance was repeated till 11 erupted fully in a normal over jet relation. A twenty-four month follow-up of the child showed stability of the results (fig 1d-f). The cephalometric changes at 24 months, highlighted an improvement in the ANB (Table 1.)

**Fig 1a. Cross bite of primary anterior teeth in a six-year-old boy**

**Fig 1b. Posterior bite plane in acrylic for the maxillary arch**

**Fig 1c. 11 erupting in edge-to-edge relation, 21 erupting normally**

**Figs 1d-f. Stable normal over jet relation at 24 months follow-up**

**Pre and Post facial profile.**

**Table 1 (Cepalometric changes)**

| | PRE | POST |
|---|---|---|
| Saddle Angle (N-S-Ar) | 121.5 | 118.8 |
| Articular angle (S-Ar-Go) | 140.0 | 140.4 |
| Gonial Angle (A-Go-Me) | 128.1 | 126.4 |
| Bjork's sum | 389.6 | 397.6 |
| Y-axis | 62.7 | 62.0 |
| FMA | 20.7 | 22.1 |
| SNA | 81.4 | 83.4 |
| SNB | 83.1 | 80.8 |
| ANB | -1.7 | 2.6 |
| Wit's Appraisal | -3.7 mm | -2.6 mm |
| SN Length | 63.8 mm | 67.2 mm |
| Maxillary Length | 73.4 mm | 79.0 mm |
| Mandibular length | 92.8 mm | 96.5 mm |
| SN-MP | 29.6 | 26.8 |
| Upper Incisor to palatal plane | 100.1 | 116.0 |
| IMPA | 93.0 | 94.1 |
| Inter-incisal angle | 145.9 | 124.5 |

*Saggital Expansion Appliance (For Type 1b case)*

## Case 2

A three and a half-year-old girl reported with an anterior deep bite and primary maxillary incisors in reverse over jet relation (Fig. 2a). The maxillary incisors were also lingually tipped and there was a vertical overbite of nearly 4 millimeters. A functional shift and a positive family history were absent. Since the child was very young and there was no obvious signs of a true class III malocclusion tendency a cephalogram was not taken at that time. A maxillary appliance with posterior bite planes for disocclusion and an anterior expansion screw (in sagittal mode) was delivered to the patient (Fig.2b). The parents were instructed to follow an activation schedule of a quarter turn every third day. The cross bite was corrected in two and a half months (Fig. 2c). Further activation of the appliance was stopped and patient continued using the same appliance, which was periodically trimmed of the posterior bite acrylic, till the occlusion settled, which happened in less than a month. The appliance was discontinued after settling of occlusion. The patient, however, was an outstation case and did not report for long-term follow-up after correction.

**Fig.2a Primary anterior cross bite with deep bite in a three and a half-year-old girl**

**Fig.2b-c. Maxillary expansion appliance in saggital mode and corrected cross-bite**

**Pre and Post facial profile pics.**

*Removable Mandibular Retractor (For Type 2 case)*

## Case 3

A five and a half-year-old boy reported to the Pediatric Dental OPD with an edge-edge relation of all primary incisors (Fig. 3a). There was also proximal caries in relation to 51 and 61. The child had a concave profile with a history of a class III malocclusion in the grandfather. A functional shift of mandible was also absent. Cephalometrically the child showed no evident skeletal discrepancy (Table 2) .The proximal caries was restored with composite. A mandibular retractor was chosen as the treatment modality and was fabricated on the dental casts from the prepared alginate impressions of the arches (Fig. 3b**).** Compliance with the appliance was excellent and the cross bite got corrected after about four months of regular wear of the appliance (Fig. 3c**).** The appliance was however continued for another four months and at each follow up visit the labial bow was activated to lightly rub the labial surface of lower incisors on closure. At a follow-up visit after two years the primary maxillary incisors were exfoliating and permanent maxillary central incisors were found to be erupting in an edge-to-edge relationship, soon after that. (Fig.3d). The second mandibular retractor appliance was fabricated on newly prepared dental casts and the patient made to

**Fig 3a. Edge to edge relation of all primary incisors in a five and half year old boy**

**Fig.3 b A removable mandibular retractor on the maxillary arch**

**Fig.3.c Corrected cross bite relation**

**Fig 3d. Permanent maxillary incisors erupting in cross bite relation**

**Fig. 3 e. Re fabrication of the removable mandibular retractor**

**Fig. 3f Corrected permanent incisor cross bite**

**Fig. 3g-i Without relapse at 36-months follow-up**

**Fig. 3g**

**Fig 3h**

**Fig. 3i**

**Change in facial profile**

wear it till complete eruption of the incisors and establishment of a normal over jet relation (Fig. 3e,f). The desired effect was achieved in 4 months, following which the appliance was discontinued. The patient has been followed up for another three years since appliance discontinuation, with no relapse and a stable occlusion (Fig. 3g-i**)**. Cephalometric changes after correction of cross bite in the primary dentition (Post 1) and at three years follow-up (Post 2) are highlighted in Table 2.

**Table 2. Cephalometric changes**

| | PRE | POST 1 | POST 2 |
|---|---|---|---|
| Saddle Angle (N-S-Ar) | 110.9 | 111.6 | 115 |
| Articular angle (S-Ar-Go) | 141.3 | 145.0 | 150.6 |
| Gonial Angle (A-Go-Me) | 135.5 | 129.3 | 121.3 |
| Bjork's sum | 387.8 | 385.8 | 386.9 |
| Y-axis | 59.2 | 57.2 | 60.8 |
| FMA | 26.6 | 23.2 | 24.6 |
| SNA | 84.0 | 85.0 | 82.0 |
| SNB | 84.1 | 84.0 | 81.9 |
| ANB | -0.2 | 1.0 | 0.1 |
| Wits Appraisal | -3.1 mm | -1.7 mm | -2.6 mm |
| SN Length | 57.1 mm | 69.1mm | 64.5 mm |
| Maxillary Length | 61.7 mm | 77.8 mm | 73.8 mm |
| Mandibular length | 78.2 mm | 97.0 mm | 91.1 mm |
| SN-MP | 27.8 | 25.8 | 26.9 |
| Upper Incisor to palatal plane | 110.6 | 107.6 | 129.8 |
| IMPA | 89.9 | 105.9 | 99.7 |
| Interincisal angle | 136.7 | 122.9 | 109.9 |

## DISCUSSION

The objective of interceptive orthodontics is not only correction of function & facial aesthetics but also to prevent deterioration of existing problem, provide a more favorable environment for subsequent normal growth which in turn contributes towards normal psychological development of the child[3,10,11]. Early corrective orthodontics in primary dentition averts abnormal growth of both the skeletal and dentoalveolar structures. With the eruption of permanent teeth, self-correction of anterior cross bites in primary teeth too has been reported[12]. Nagahara *et al* (2001) have devised a 'Deciduous indicator' to enable identification of subjects who require treatment versus those which will possibly show self correction, based on cephalometric analysis of 44, 3-year-old children who were followed till transitional dentition for changes in their anterior cross bite[13]. Anterior cranial length, posterior facial height, porion location and Wits appraisal were used as predictor variables and a lower DI value was correlated with a higher probability of cross bite to self-correct during transitional dentition. The equation used on the same sample resulted in only one error each in the two groups. The 'Deciduous Indicator" requires cephalometric X-rays and as per the present clinical protocol at our tertiary care center, cephalometric X-rays for cases of primary dentition cross bite, are not taken until the case presents with signs of a true class IIII tendency very early in the primary dentition. In our opinion, it may not be prudent to wait at the risk of allowing the skeletal discrepancy to develop or worsen, as simple interceptive appliances can resolve anterior cross bite in the primary teeth. Tollaro *et al* have shown that, signs of skeletal disharmony such as maxillary retrusion and a larger length of mandibular ramus are more evident in children with anterior cross bite by 6 years than at 4 years. [14]. Baccetti and Tollaro (1998) have also shown that management of cross bite carried out early in the primary dentition using mandibular retractor produces a more significant skeletal change than that carried out later in the mixed dentition[7]. Treating these cases as early as possible, therefore, offers the best chance to achieve normal skeletal relationship. Single tooth cross bites or unilateral cross bites may, however, be left unattended in an uncooperative child to be followed till the child is more manageable.

Further in **Type 1a** cases such as in case 1, there is no positive family history and no clinical signs of a true class III tendency but presence of a cross bite due to functional shift as a result of a long standing occlusal prematurity. These features are also present in cases reporting early, almost as soon as the primary dentition is complete. These cases may show a concave profile when the child closes in cross bite. Functional shift of the mandible is best confirmed by letting the child bite slowly from the maximum jaw opening and observing the incisor teeth coming in edge to edge bite and then finally closing in crossbite position of the incisors. The anterior teeth, however, show normal inclination, as in the present case. Simple disocclusion appliances along with gentle exercises for closure in a true centric relation taught to the child as well as the parent are considered ideal and will work very well for the management of such cases. Routinely, disocclusion maxillary appliances are given but mandibular may also be given in cases reporting prior to eruption of primary maxillary second molars. In the present case, the patient complied well with the appliance and it was successful in correcting the cross bite in a period of two months. Ramirez-Yanez et al[4] have described a case of successful use of composite inclined planes called Planas Direct Tracks for correction of cross bites in primary dentition in a four and a half-year old girl child. They claimed that composite blocks on primary molars were used to guide the mandible backwards and the maxillary anteriors achieved a normal position due to forces delivered by the tongue. The idea of using composite on molars for disocclusion can be useful in cases where the required incisor overlap is minimal.

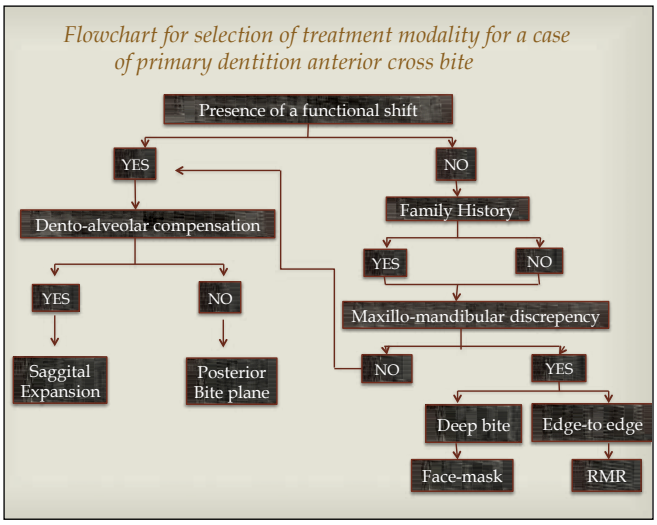
Sometimes, an abnormal dentoalveolar relation is present or established over a period of time if the anterior cross bite is not corrected early, and these we have classified as **Type 1b**, with either lingually inclined upper incisors or a deep vertical overbite, indicative of a low angle class III malocclusion as in present case 2 of the series, which has also been reported as a common tendency in class III malocclusion in primary dentition with anterior cross bite[14]. The functional shift test performed clinically, though markedly improves the maxillo-mandibular relationship to some extent, but may not be complete, due to the severity of an abnormal dento-alveolar relation. For such cases, a saggital expansion appliance with posterior bite plane is considered ideal as it would correct the positional alteration of the tipped incisors and also slightly disocclude the bite. One factor to be considered prior to using expansion as a treatment modality is the amount of root resorption of primary anterior teeth. In children over 5 years, an expansion appliance may hasten the exfoliation if the root resorption is more than half. An intra-oral periapical x-ray of teeth in crossbite, prior to treatment planning is, therefore essential. Vadiakas *et al* [8] used a maxillary fixed expansion appliance with a wire bent as W-arch with extended arms to the maxillary anteriors, delivering light continuous forces for correction of primary anterior cross bite; correcting the cross bite in 4 months. Such an appliance may be indicated for non-compliant patients but needs extra hardware.

**Type 2** primary dentition incisor cross bite cases will present with a concave profile, minimal vertical overbite or deepbite, lingually inclined mandibular anterior teeth, a steep mandibular plane along with early signs of a short maxilla or an overgrowing mandible and usually with a positive family history. It is important

to take cephalometric radiographs to monitor further changes in growth. In cases with minimal vertical overbite and a steep mandibular plane angle, as in case 3, a removable mandibular retractor is an ideal choice as it is the only appliance, which does not lead to further accentuation the mandibular plane angle. It is constructed to work as a true functional appliance where the labial arch, following on the lower incisors, is intended to work as a stop providing proprioceptive stimuli for restriction of forward growth of the mandible[15]. A reciprocal effect is seen in the maxilla from which the retention is taken. Tollaro and Baccetti have further corroborated the findings extensively and have shown that it (mandibular retractor) induces skeletal changes such as an upward and forward direction of condylar growth, which induces anterior morhogenetic rotation of the mandible as a compensation for excessive mandibular growth[5,6]. Moreover, since this appliance does not have a vertical vector of force it does not affect facial height and intermaxillary vertical relationships due to bite opening as mentioned earlier.. The patient compliance in the present case was excellent, and the cross bite resolved uneventfully and the permanent incisors erupted in a normal overjet relation. Those with a positive family history along with an established skeletal discrepancy, and absence of functional shift along with a deep bite would be candidates for a facemask therapy. (***Flow chart 1).*** It has also been documented that the saggital response to facemask therapy is greater when given in primary and early missed dentition stages than later[16,17]**,** further emphasizing the importance of early interception, irrespective of the treatment modality required**.**

The review of literature reveals many investigators to have reported successful uses of varied appliances for management of primary dentition cross bites; their rationale and outcome. Franchi and Baccetti[9] reported successful use of maxillary and mandibular bioacryl splints with class III elastics for correction of cross bite in two cases aged 4 and 5 yeas. The authors[9], however quoted the strategy to be particularly indicated for early treatment of class III malocclusion associated with normal or low-angle vertical relationship and proposed the use of addition of high-pull chin therapy to splint therapy, to counteract any bite-opening tendency. Yuan Shu Ge *et al* [3] in their study evaluated the post-treatment outcomes of posterior bite raising in combination with a 2x4 appliance in 46 children with primary anterior cross bite, with mean age of 4 years two months and a DI value greater than zero. Immediate correction was seen in all cases within six months. However, 11 of the 46 children showed relapse in the permanent dentition at a six-year follow-up due to unfavorable growth such as a significantly greater SNB, smaller ANB and gonial angle approximately 10.7 degrees greater than the children with no relapse. The authors concluded the therapy to be effective and successful, meeting all the objectives of an interceptive modality. Ramirez-Yanez *et al* [2] reported use of pediatric strip crowns for maxillary anterior teeth with a slightly changed longitudinal axis of the crowns in three cases of primary anterior cross bites with positive results. The modality however, seems more justifiable to be used in cases where the crowns are indicated for reasons other than cross bite, and may have limited applicability in management of cases such as case 1 of the present series. Before selecting any appliance for management, however, it is very essential to differentially diagnose the case and appropriately classify it[18]. The Pediatric Dentist can use the following flow chart 1 as a guide for decision-making.

**Flow chart 1**




## CONCLUSION

The clinician should carefully select a treatment modality for management of primary incisor cross bite for achieving a predictable outcome with the simplest possible intervention. The appliance for the correction of anterior cross bite in the primary teeth may be shortlisted into three appliances; functional appliances like the removable mandibular retractor, saggital expansion appliances and simple disocclusion appliances. The removable mandibular retractor is most suited for cases showing skeletal discrepancy and a true class III malocclusion tendency. Cases with dentoalveolar abnormalities can be corrected using a saggital expansion appliance with a disocclusion mechanism. Those only with a functional shift and no abnormal dento alveolar relation can be managed using simple disocclusion appliances or composite molar blocks in select cases and addressing the occlusal prematurities. A close follow-up to monitor long-term growth changes and interventions delivered if required is important to maintain stability of the results achieved.

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