

New Approach to Treatment of Incipient Malocclusion with 3 Way Expansion Appliance

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Abstract

Introduction: Anterior and posterior crossbites can be caused due to dental discrepancies and can co-exist, during the mixed dentition period. The most common problem is lack of space for the erupting permanent successors. If not intervened at an early age this can lead to muscular problems including mouth breathing, resulting in a constricted maxilla or palatal tipping of the maxillary teeth. Other muscular problems include functional shift due to occlusal interferences, sucking habits and abnormal pattern of mandibular closure. Cross bites may lead to abnormal enamel abrasion or proclination of the mandibular incisors, which, in turn, leads to thinning of the labial alveolar plate and/or gingival recession. Many

different methods have been used to expand the constricted maxillary arches but these procedures can bring about expansion only in the anterior region or the posterior region, at one time.

Material and method: Simultaneous correction of anterior and posterior crossbite can be done, during mixed dentition period, was done with the help of a three way expansion appliance. The patients were instructed to wear this appliance full-time (day and night). Expansion is continued until the desired transverse and sagittal correction of the maxillary posterior and anterior segments is achieved.

Result: In our study the desired results were obtained in a brief period of 8 to 9 months.

Conclusion: Dentists, especially Pediatric dentists, and Orthodontists, will find this appliance useful in managing narrow maxillary arches exhibiting dental crossbites that coexist in the anterior and posterior segments, during the mixed dentition period.

Keywords: Crossbite, Three way, Expansion, Mixed dentition

Introduction

A crossbite is defined as an abnormal labiolingual or buccolingual relationship between maxillary and mandibular teeth when the teeth of both arches are in occlusion. It can be further defined to specify the location in the mouth i.e. whether anterior or posterior and also whether a single tooth or groups of teeth are involved. The prevalence of crossbite has been reported to range from 7% to 22% in Western countries¹. In India, the prevalence has been reported to range from less than 2% to 16% in young children and adolescents. Crossbite has also been reported to occur more frequently in females.² However in certain situations anterior and posterior crossbites coexist and need speedy correction.

Anterior and posterior crossbite can be caused by dental or skeletal problems. The most common problem of, an anterior and posterior dental crossbite coexisting, is lack of space for the permanent successors. If not intervened at an early age the muscular problems include mouth breathing resulting in a constricted maxilla or palatal tipping of the maxillary teeth. Other muscular problems include functional shift due to occlusal interferences, sucking habits and abnormal pattern of mandibular closure. Multitooth crossbite can be the result of functional shift due to incisor interference, which causes the mandible to be displaced forward to achieve maximum intercuspation⁵. Crossbites may lead to abnormal enamel abrasion or proclination of the mandibular incisors, which, in turn, leads to thinning of the labial alveolar plate and/or

gingival recession. Mandibular shift caused by abnormal mandibular movements may place strain on the orofacial structures, causing adverse effects on the temporomandibular joints and masticatory system^{6,7}.

Many different methods have been used to expand the constricted maxillary arches. When evaluated on the basis of the frequency of the activations, magnitude of the applied force, duration of the treatment, and the patient's age, different mechanics produce rapid, semirapid, and slow expansions. The objective of rapid maxillary expansion is to increase the transverse width of the maxillary dental arch at the apical base with minimal concomitant movement of the posterior teeth within the alveolus. The displaced maxillary segments require a lengthy period of rigid stabilization in order to allow sutural readjustment and dissipation of accumulated residual forces of the maxilla. Slow expansion appliances(SME) promote a slight opening in the median palatine suture in the primary and mixed dentition stages.. SME procedures produce less tissue resistance around the circummaxillary structures and, therefore improve bone formatio^{8,9,10} This expansion is possible only in one direction at a time.ie. either anterior or posterior. Anterior and posterior crossbites in the early mixed dentition are believed to be transferred from the primary to the permanent dentition and can have long-term effects on the growth and development of the teeth and jaws.¹¹ Early cross-bite corrections lead to a stable and normal occlusion pattern and contribute to symmetrical condylar growth, TMJ, and overall growth in the mandible. However, a lack of awareness of the parents or financial constraints prevent some children with anterior and posterior crossbites seeking early correction. This may result in crowding with insufficient space for eruption and alignment of the erupting teeth and require simultaneous correction of the anterior and posterior crossbite, in a

short span of time, to avoid extraction of the newly erupted permanent teeth¹².

Materials and Methods

Three Way Expansion Appliance: The unique 3-Way Expander features three independently expanding sections in one housing -- for transverse as well as sagittal anterior development. Each section can be independently activated. When an equal amount of lateral development is desired, turn the two lateral sections at the same time. If a differential amount of lateral development is needed, by turning one of the lateral sections, the rest of the appliance will act as an anchorage unit -- making unilateral movement possible. This is an excellent appliance if the size of the palate is not very constricted to handle the dimension of the screw. Activation of the screw is 1-2 times per week. Patients should wear 24 hours a day and clean daily with toothpaste to prevent the buildup of plaque and odour. If the patient exhibits a tongue thrusting habit a tongue crib can be incorporated on to this appliance. The posterior bite plane can be trimmed when the crossbite has been corrected and the appliance can be used as a retainer till the occlusion settles. (odlortho.com/product/3-way-appliance/)



Fig 1

Three children who came to the pediatric clinic with chief complaints of incipient malocclusions were chosen for the treatment with the three-way-expansion appliance. Three cases with different clinical situations of incipient malocclusions were corrected using the three way expansion appliance and has been explained for the benefit of the clinician.

A 7-year-old girl, reported to the department of pediatric and preventive dentistry, with a deviation of her mandible to the right side, which was increasing as more permanent teeth were erupting. Intraoral examination revealed an occlusal interference of the deciduous canine with a sagittal and a transverse discrepancy as an anterior and posterior crossbite.

Pre op



Figure 2

The patient was scheduled for limited early interceptive treatment to restore normal occlusion and alleviate the underlying functional shift. To reach these objectives, the treatment approach considered was slow maxillary expansion using the above mentioned 3-way expansion appliance with posterior bite plane to bring about simultaneous correction of anterior and posterior crossbites



Figure 3

post op

A 7 year old girl reported with a coexisting anterior and posterior crossbite with premature loss of mandibular canines and space closure in the region. She was seen to

exhibit a mouth breathing habit and an accompanying low tongue position. Masslers's water holding exercises were advocated to habituate the patient to nasal breathing. She presented with a mixed dentition and exhibited class 1 molar relationship. There was insufficient space for eruption of her anterior teeth because of a narrowed maxillary arch. Her profile was pleasant. The patient was scheduled for early interceptive treatment to restore normal occlusion and alleviate the underlying crossbite. The treatment approach considered was slow maxillary expansion using the above mentioned 3-way expansion appliance with posterior bite plane to bring about simultaneous correction of anterior and posterior crossbite to create space for the erupting permanent teeth.

Pre op



Figure 4

Post op



Figure 5

A 11 year old boy presented with a reverse overjet and generalised constriction of the maxilla. He had anterior and posterior dental crossbite with a class I molar relationship. Lateral cephalogram confirmed that there was no deficiency of maxilla.

Pre op



Figure 6

Post op

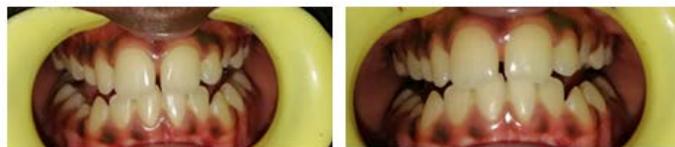


Figure 7

The treatment approach considered here too was a slow maxillary expansion using the above mentioned 3-way expansion appliance with posterior bite plane to bring about simultaneous correction of anterior and posterior crossbite

Upper and lower alginate impression were made for fabrication of the 3-way expansion appliance, with a posterior bite plane, to relieve the occlusal interference. The patients were instructed to wear the appliance full-time (day and night) The patient's parents were instructed to activate the expansion screw, one turn twice weekly, both for transverse and sagittal expansion. After each meal and before sleeping, the patients were advised to brush the teeth and the appliance, before reinserting it. Patient was recalled periodically for review. Expansion was continued, until the desired anterior and posterior relation of the maxillary teeth were achieved.

Result

The desired results were achieved in a very short duration of time.(6 to 9 months) in all the three cases. The three way expansion appliance showed significant changes in the crossbite correction in a short duration of time. The three-way-expansion appliance which is basically an slow maxillary expansion appliance (SME) showed significant dentoalveolar changes due to maxillary expansion.

Discussion

The early correction of anterior and posterior dental cross-bites requiring maxillary expansion has been advocated so as to redirect the developing teeth into more normal positions, eliminate untoward temporomandibular joint position and mandibular closure pattern, and make

beneficial dentoskeletal changes during growth period that involves a reduced treatment complexity and time^{3,4} The 3-way expansion appliance corrects the anterior and posterior crossbite with a single appliance, thereby correcting the occlusion in a short period of 8-9 months. Increase in maxillary arch width has been related to orthodontic movements, orthopedic movements, or a combination of these movements during expansion procedures especially in mixed dentition periods. Slow expansion procedures are seen to produce less tissue resistance around the circummaxillary structures and, therefore improve bone formation in the intermaxillary suture in the mixed dentition stage¹⁴ Early correction of crowding, with the 3-way expansion appliance, in the mixed dentition period help create space for the erupting permanent teeth. The relative degree and nature of these movements is affected by various factors but there is a general pattern of maxillary expansion with the 3-way expansion appliance. Upon the application of transverse and sagittal biomechanical forces, initial changes involve the lateral tipping of the anterior and posterior maxillary teeth as the periodontal and palatal soft tissues are compressed and stretched.¹³ This finding was similar in the treatment with 3-way expansion appliance also. If the applied transverse and sagittal forces are of sufficient magnitude to overcome the bioelastic strength of sutural elements, mild orthopedic separation of the maxillary segments can occur with the 3-way expansion appliance too. Slow expansion appliances promote a slight opening in the median palatine suture in the primary and mixed dentition stages and this was seen with the 3-way expansion appliance too. SME occurs by more intermittent and lower forces that are applied over longer periods. According to studies, 10 to 20 newtons of force should be applied to the maxillary region, but only 450 to 900 gm of force is generated. Maxillary arch-width

increases ranged from 3.8 to 8.7 mm with slow expansion of as much as 1 mm per week using 900 gm of force.^(3, 14-15) The 3-way expansion appliance produces these changes in the transverse and sagittal directions simultaneously and bring about changes in the anterior and posterior segments, thereby considerably reducing the duration of treatment. It delivers a constant physiologic force, in both the directions, until the required correction of crossbite is obtained. The patient compliance has a huge role to play in the success of this appliance too. The 3-way expansion appliance is light and comfortable enough to be accepted by the child patient. Parents find it easy to follow instructions to activate the appliance twice every week. Being easy to wear the 3-way expansion appliance can be worn for longer periods to promote greater postexpansion stability¹⁵.

Conclusion

Correction of anterior and posterior crossbite, occurring in the mixed dentition stage in children, causes severe deficiency in space for the newly erupting teeth resulting in crowding, ectopic eruptions, impactions and premature contacts. The situation is worsened when treatment is delayed causing deviation in the mandible, finally affecting the proper growth and development of the dentofacial skeleton. Simultaneous correction of the sagittal and transverse discrepancies in a short period of time, by the help of these appliances, can prevent psychological trauma to the patient, besides eliminating long term orthopedic and orthodontic corrections later in life. Not many references for this appliance and its treatment was found on the search in the existing literature.

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