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# Simplified Fixed Technique for Correction of Anterior Crossbite: A Case Series

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## ABSTRACT

Anterior crossbites would normally require early intervention, especially when associated with mandibular displacements. The intervention would usually commence in children around the age of eight and nine, where treatment could be a challenge at this age. Therefore, a simple and quick treatment to this malocclusion would be desirable. This case series illustrates two cases of anterior crossbite with a functional shift that were successfully corrected using a simplified fixed technique, which involved a short-span nickel-titanium (Ni-Ti) aligning round archwire, composite resin and glass ionomer cement (GIC).

***Keywords:*** *Anterior crossbite; interceptive orthodontics; mixed dentition*

## INTRODUCTION

Anterior crossbite is defined as an abnormal incisor relationship wherein one or more maxillary incisor teeth occlude lingual to the mandibular incisor teeth. This could be due to skeletal or dental in origin. The prevalence of anterior crossbite is between 2.2% and 11.9% which varies according to the studied populations, age group, and the criteria used to define anterior crossbite (Thilander & Myrberg, 1973; Keski-Nisula *et al.*, 2003; Karaiskos *et al.*, 2005; Lux *et al.*, 2009; Vithanaarachchi & Nawarathna, 2017). As anterior crossbites are commonly established in the early mixed dentition, interceptive treatment is vital to avoid further complications. Untreated anterior crossbite may cause damage to the teeth in crossbite which includes gingival recession (Bollen, 2008), tooth mobility (Jones & O'Neill, 1996), loss of surrounding alveolar bone support, (Bollen, 2008; Vithanaarachchi & Nawarathna, 2017) and enamel wear (McKeown & Sandler, 2001). Besides, there are possibilities of temporomandibular joint (TMJ) pain (Thilander *et al.*, 2002), aesthetic deterioration, compromised quality of life (QoL) (Piassi *et al.* 2016), and development of a true class III malocclusion or facial asymmetry (Valentine & Howitt, 1970). There are more than 12 treatment modalities for correction of anterior crossbite which ranges from the least invasive technique using the tongue blade to surgical repositioning (Borrie & Bearn, 2011).

 

The most common approach, however, is using a removable or fixed appliance. Both were reported to have a successful outcome with good long-term stability (Wiedel & Bondemark, 2014; 2015). Each approach has its advantages and disadvantages. Removable appliances omit the need for etching, bonding and debonding, allow better oral hygiene care, and are effective for pure tipping movement. However, they may cause speech difficulty and discomfort due to the palatal coverage. They also have less control of tooth movement, easily broken and misplaced, could progressively loosen with time, and most importantly they rely on patient compliance. Fixed appliances could overcome the issue of compliance and have a comprehensive range of tooth movements; however, they are not easy to keep clean which may lead to enamel decalcification. Furthermore, the brackets and wires may cause ulceration and in some cases, could be detached from the tooth surface and ingested by the patient (Milton *et al.*, 2001; Wilmott *et al.*, 2016). This case series demonstrates two cases of anterior crossbite, which were successfully corrected using a simplified, less invasive fixed technique.

### The Simplified Fixed Technique

This technique comprises of a short-span nickel-titanium (Ni-Ti) aligning round archwire, which is cemented directly on the labial surface of the maxillary tooth in crossbite and the tooth adjacent to it without the use of any bracket. The size of the aligning archwire depends on the amount of displacement between the tooth in crossbite and the adjacent tooth, at the same time giving consideration to patient comfort. The adjacent tooth must be of equivalent size or larger as it is intended to act as an anchor. Normal bonding technique is used to cement the archwire, which includes etching the enamel surface of the respective teeth with 37% phosphorus acid followed by the application of bonding agent and light-cured composite resin (3M™ Transbond™ XT). Firstly, the archwire is cemented onto the anchor tooth, before being deflected with a tucker for full adaptation on the labial surface of the tooth in crossbite. Two mm thickness of Glass ionomer cement (GIC) bite blocks are placed on the occlusal surface of the permanent maxillary first molars (tooth 16 and tooth 26) to raise the bite.

## CASE REPORT

### Case 1

A 9-year old, fit and healthy girl was unhappy with the appearance of her front teeth. She presented with a Class III malocclusion on a skeletal 1 base with average vertical proportions. She was in the early mixed dentition with retained deciduous maxillary left lateral incisor (tooth 62) and unerupted both permanent maxillary lateral incisors (tooth 12 and tooth 22). She had sustained premature loss of the deciduous maxillary left first molar (tooth 64) due to caries while the deciduous maxillary left second molar (tooth 65) had a large cavity. There was spacing in the maxillary arch (Fig. 1[a]). This was complicated with an anterior crossbite between the permanent maxillary right central incisor (tooth 11) and the permanent mandibular right central incisor (tooth 41), associated with 1.5 mm forward mandibular displacement (Fig. 1[b–c]). Tooth 41 was impaired with gingival recession and grade II mobility (Fig. 2). Relative to the facial midline, the lower dental midline shifted to the left by 2 mm while the upper dental midline shifted to the right by 1 mm. The overjet and overbite were minimal, measuring around 2 mm and 15%, respectively. Her oral hygiene was generally fair and acceptable.

#### *Treatment Plan*

The orthodontic plan was mainly to correct the anterior crossbite and eliminate the premature contact on tooth 11 using the simplified fixed technique. Ideally, tooth 65 should be restored first but considering the condition of the tooth 41, orthodontic treatment commenced immediately following


**Fig. 1** (a) Pre-treatment photograph of the maxillary dentition; (b) Pre-treatment photograph of tooth 11 and 41 in crossbite, taken in centric occlusion; (c) Pre-treatment photograph of tooth 11 and 41 in crossbite, taken in centric relation; (d) Post-treatment photograph of the maxillary dentition; (e) Short-span Ni-Ti 0.018" archwire cemented on tooth 11 and 21; (f) Post-treatment photograph of corrected anterior crossbite, taken 32 days after the treatment commenced; (g) Post-treatment photograph at 17 months after correction of the anterior crossbite.


**Fig. 2(a–c)** Pre-treatment photographs of tooth 31 with gingival recession.

discussion with the patient and her father. A short-span Ni-Ti 0.018" round archwire was cemented on the labial surface of tooth 11 and the permanent maxillary left central incisor (tooth 21) without the use of any bracket. Two mm thickness of GIC bite blocks were placed on the occlusal surface of tooth 16 and tooth 26 to disocclude the bite and relieve the anterior crossbite. Tooth 65 was unhindered for normal cleaning. A referral was made to her dentist for restoration of tooth 65.

### *Treatment Progress*

The patient was first reviewed 32 days after the treatment commenced. At this appointment, the patient claimed that the previous 32 days were uneventful. The anterior crossbite was corrected successfully and the premature contact together with the functional shift was eliminated (Fig. 1[d–f]). The archwire and composite resin were intact and the oral hygiene remained acceptable. The GIC bite blocks on tooth 16 and tooth 26 had worn-down. Patient was happy with her teeth; hence the archwire was removed at the same appointment along with the composite resin and GIC. The composite resin was initially removed from one tooth surface first, to allow part of the archwire to be secured with Spencer-Wells forceps before removing the composite resin from the other tooth surface to avoid risk of ingestion or inhalation. On other observation, tooth 62 had exfoliated while tooth 12 and tooth 22 had started to erupt. Tooth 65 remained unrestored, as the patient did not get a chance to visit her dentist. Patient was reinforced on the importance of restoring tooth 65 as soon as possible.

### *Retention*

The corrected occlusion was retained with a good positive overbite. At 17 months' review, a positive overjet and overbite of the incisors was maintained (Fig. 1[g]). Both maxillary lateral incisors had fully erupted and tooth 65 had been restored. Comprehensive orthodontic treatment could be considered in the future if necessary.

## Case 2

A 7-year old fit and healthy anxious boy was referred by his dentist for further management of a crossbite. He presented with Class I malocclusion on a skeletal 1


**Fig. 3** (a) Pre-treatment photograph of the maxillary dentition; (b) Pre-treatment photograph of tooth 21 and 31 in crossbite; (c) Mid-treatment photograph of the maxillary dentition; (d) Mid-treatment photograph of corrected anterior crossbite, taken 38 days after the treatment commenced; (e) Post-treatment photograph at 13 months after correction of the anterior crossbite.

base with average vertical proportions. He was in the early mixed dentition with firm deciduous maxillary lateral incisors (tooth 52 and tooth 62) and a retained root of the deciduous mandibular left central incisor (tooth 71). Tooth 64 was extracted due to caries. This was complicated with an anterior crossbite between tooth 21 and the permanent mandibular left central incisor (tooth 31) with minimal forward mandibular displacement of approximately 1 mm (Fig. 3[a–b]). There was subtle enamel attrition on the incisal edge of tooth 21. In relation to the facial midline, the upper dental midline shifted 1 mm to the left while the lower dental midline shifted 2 mm to the right. The overjet and overbite were average. His oral hygiene was fair and acceptable.

### *Treatment Plan*

Similar to Case 1, the orthodontic plan was to correct the anterior crossbite and eliminate any premature contact, using the simplified fixed technique. Upon discussion with the patient and his father, a short-span nickel titanium (Ni-Ti) 0.018" round archwire was cemented on the labial surface of tooth 11 and tooth 21 without any bracket. GIC bite blocks of 2 mm thickness were placed on the occlusal surface of tooth 16 and tooth 26 to open the bite beyond the depth of the crossbite. The plan also included a referral to his dentist for removal of the retained root of tooth 71, which was asymptomatic.

### *Treatment Progress*

The patient came for his first review appointment, 38 days after the treatment commenced. The past 38 days were described as unexceptional by the patient. The anterior crossbite was found successfully corrected and the premature contact was eliminated (Fig. 3 [c–d]). The archwire and the composite resin were intact while the GIC bite blocks on tooth 16 and 26 had worn-down. Oral hygiene was satisfactory. For this case, the archwire was not removed immediately as the contact point displacement between tooth 11 and tooth 21 was more substantial than the previous case, which increases the probability for relapse. Hence, the archwire was kept in situ for another month, for stability. The next appointment was given a month later or 71 days after the treatment started to remove the archwire, excess composite and GIC. The retained root of tooth 71 was still present at both review appointments as the patient was very anxious. However, he was reminded of the importance of having it removed.

### *Retention*

The corrected anterior crossbite was retained with a good positive overbite. At 13 months review, a positive overjet and overbite of the incisors was maintained (Fig. 3[e]). Both maxillary lateral incisors had fully erupted and the retained root of tooth 71 had been removed. Comprehensive orthodontic treatment could be considered later if necessary.

## DISCUSSION

Correction of anterior crossbite is deemed successful when a positive overjet and overbite is achieved, with the incisors within the normal interincisal relationship (Wiedel & Bondemark, 2015). Both cases have shown this outcome after a month; hence the simplified fixed technique could be considered as successful and effective. Despite various treatment modalities to correct anterior crossbites, a desirable technique is one that is simple, non-invasive, requires little chairside time, involving minimal patient cooperation and provides rapid correction of the crossbite (Borrie & Bearn, 2011). Removable appliances almost fulfil these criteria as they clearly require little chairside time and provide rapid correction of the crossbite (Wiedel & Bondemark, 2014), but the biggest challenge, especially dealing with small children is patients' compliance. Fixed appliances could overcome the issue of compliance as they are fixed to the teeth and patients have no

control over it. However, they could be more invasive than removable appliances as they are difficult to clean, pose a risk of ulceration and the brackets may be dislodged and ingested (Milton *et al.*, 2001; Wilmott *et al.*, 2016). The required chairside time with fixed appliances is arguably longer than removable appliances as the teeth need to be prepared and isolated followed by the placement of brackets and archwire. Many fixed appliance techniques have been reported, with a trend towards simplicity.

One technique involved placing brackets on eight maxillary anterior teeth including the deciduous maxillary canines and the deciduous maxillary first molars (Wiedel & Bondemark, 2014). This may not be ideal as deciduous teeth that are subjected to orthodontic forces could lead to accelerated root resorption and premature exfoliation (Consolaro, 2015). Another technique is known as 2×4 appliance wherein only the permanent teeth were included. Brackets were placed on the four permanent maxillary incisors and bands were fitted on both permanent maxillary first molars (McKeown & Sandler, 2001). This technique appears desirable but not without shortcomings such as difficult band fitting if the molars are not fully erupted or have a short clinical crown, discomfort during band fitting which may demotivate the patients, long span of the unengaged archwire which could pose problems during chewing and brushing, and plaque retention especially around the molar bands. Hence, to overcome issues with the 2×4 appliance, another technique has been reported whereby only the anterior teeth were involved, with brackets placed on either two central incisors or extended to the lateral incisors (Sockalingam *et al.*, 2018). It is important to note that the thickest archwire used with this technique was either Ni-Ti 0.016" or Ni-Ti 0.014" round archwire. Likewise, the thickest archwire used in two out of four original cases shown with the 2×4 fixed appliance was a round archwire. Thus, the need for brackets is disputable, as a small-sized round archwire in a 0.022" bracket slot will not express the bracket prescriptions. On this note, the simplified technique is suggested wherein the archwire is directly attached with composite resin to the tooth in crossbite and the adjacent tooth without using any bracket. The correction of anterior crossbite results from dental proclination of the incisor. GIC with 2 mm thickness is placed on the occlusal surface of tooth 16 and tooth 26 to raise the bite and relieve the crossbite.

Being a fixed technique without orthodontic brackets, this technique is advantageous as it is simple, cost-effective, easy, requires little chairside time with no lab work, minimal inventory, not bulky, reduced risk of ulceration, reduced risk of trauma to the lip if patient sustains a head trauma, less irregular surfaces for plaque accumulation, less metal components, no risk of bracket dislodgement, independent of patient compliance, not affecting speech and most importantly it has been shown to be successful. However, without orthodontic brackets, there would be a limited control of tooth movement and slightly more composite is needed to attach the archwire to the tooth surface. Even with more composite required, the cost is still lower than using orthodontic brackets.

Patient selection is crucial. This simplified technique should be limited to anterior crossbite involving a single incisor where the incisor is upright, minimally rotated and close to the line of the arch. For simplicity, only a central incisor is used as an anchor, as the main focus of this technique is to correct anterior crossbite involving a single tooth. The use of a single tooth to anchor the correction of a tooth in crossbite has been previously reported (Sunil *et al.*, 2017; Sockalingam *et al.*, 2018). The adjacent tooth that would be used as an anchor should be equivalent or larger in size than the tooth in crossbite. The periodontium surrounding the anchor tooth also should be healthy with no excessive alveolar bone loss or deep pocketing. It is favourable if the anchor tooth is normally inclined, aligned with

average overjet and overbite. A mesiolabially rotated anchor tooth away from the tooth in crossbite would provide better anchorage for this technique as the reciprocal force is beneficial and vice versa. If possible, the lateral incisors should not be included as this will make it more difficult for the patient to clean around the area and may also introduce unwanted movement of the lateral incisors, given the active nature of the Ni-Ti archwire. If the contact point displacement is excessive, the lateral incisor may be included to strengthen the anchor unit, but orthodontic brackets would usually be required.

Although this technique has restricted control of tooth movement, simple movement such as tipping, rotation, intrusion and extrusion are still applicable by manipulating the position where the archwire is fixed to the teeth as well as controlling the amount of deflection of the Ni-Ti archwire. These simple movements are adequate as the goal is to mainly eradicate premature contact and attain a positive overjet. Interceptive treatment is all about suppressing a developing detrimental malocclusion from causing further damage. Other aims such as the correction of midline shift and incisor root inclination should be considered later with a complete set of orthodontic appliances. Treatment stability would rely on a good positive overbite upon treatment completion. This is comparable to other studies looking at early correction of anterior crossbite (McKeown & Sandler, 2001; Prakash & Durgesh, 2011; Wiedel & Bondemark, 2015; Sunil *et al.*, 2017; Sockalingam *et al.*, 2018). Some advocate that treatment during early mixed dentition offers better stability (Ninou & Stephens, 1994). Subjecting the patient to an appliance or even a short-span fixed retainer for retention at a young age is rather unnecessary. The two cases in this case series have shown that adequate overbite is sufficient to maintain the stability of anterior crossbite correction after 17 months and 13 months, respectively.

Despite the strengths, there are some limitations to this technique. For example, the use of GIC bite raisers may cause discomfort to patients especially during eating. However, the discomfort is usually brief and most patients will adapt to it after several days. Furthermore, a Ni-Ti 0.018" archwire was used in both cases to provide some rigidity. The initial archwire for alignment would usually be a Ni-Ti 0.014" archwire, but due to the minimal contact point displacement between the two teeth, the amount of archwire deflection was minimal, hence the Ni-Ti 0.018" archwire was chosen. Central incisors are also typically wide; thus, the length of the archwire is also increased which allows more flexibility of the archwire. A Ni-Ti 0.014" or 0.016" archwire may be used if the contact point displacement is more prominent between the tooth in crossbite and the tooth adjacent to it. The method for composite removal at the end of treatment depends on individual preferences. One option would be to use slow-speed debonding bur throughout the process. However, to reduce chairside time, the second option would be to use a high-speed debonding bur as a first step to initially clear the outer layer of composite and this is followed by the slow-speed debonding bur to remove the remaining composite on the tooth surface. A high-speed bur was found to cause more damage to the enamel surface compared to a slow-speed bur (Cochrane *et al.*, 2012), therefore precaution must be taken in the second method, being careful not to encroach on the enamel surface until switching to the slow-speed debonding bur.

## CONCLUSION

It has been shown that the simplified fixed technique is successful for correction of anterior crossbite. However full assessment of each case is essential prior to commencement of treatment. Due to its limitations, this technique should only be used in selective cases.

## REFERENCES


Bollen AM (2008). Effects of malocclusions and orthodontics on periodontal health: Evidence from a systematic review. *J Dent Educ*, **72**(8): 912–918.

Borrie F, Bearn D (2011). Early correction of anterior crossbites: A systematic review. *J Orthod*, **38**(3): 175–184. https://doi.org/10.1179/14653121141443

Cochrane NJ, Ratneser S, Woods MG, Reynolds EC (2012). Effect of different orthodontic adhesive removal techniques on sound, demineralized and remineralized enamel. *Aust Dent J*, **57**(3): 365–372. https://doi.org/10.1111/j.1834-7819.2012.01713.x

Consolaro A (2015). Orthodontic movement in deciduous teeth. *Dental Press J Orthod*, **20**(2): 16–19. https://doi.org/10.1590/2176-9451.20.2.016-019.oin

Jones JW, O'Neill PD (1996). Anterior crossbite and mobile lower central incisors in a 7-year-old patient: A case report. *Dent Update*, **23**(7): 271–274.

Karaiskos N, Wiltshire WA, Odlum O, Brothwell D, Hassard TH (2005). Preventive and interceptive orthodontic treatment needs of an inner-city group of 6-and 9-year-old Canadian children. *J Can Dent Assoc*, **71**(9): 649.

Keski-Nisula K, Lehto R, Lusa V, Keski-Nisula L, Varrela J (2003). Occurrence of malocclusion and need of orthodontic treatment in early mixed dentition. *Am J Orthod Dentofacial Orthop*, **124**(6): 631–638. https://doi.org/10.1016/j.ajodo.2003.02.001

Lux CJ, Dücker B, Pritsch M, Komposch G, Niekusch U (2009). Occlusal status and prevalence of occlusal malocclusion traits among 9-year-old schoolchildren. *Eur J Orthod*, **31**(3): 294–299. https://doi.org/10.1093/ejo/cjn116

McKeown HF, Sandler J (2001). The two by four appliance: A versatile appliance. *Dent Update*, **28**(10): 496–500. https://doi.org/10.12968/denu.2001.28.10.496

Milton TM, Hearing SD, Ireland AJ (2001). Ingested foreign bodies associated with orthodontic treatment: Report of three cases and review of ingestion/aspiration incident management. *Br Dent J*, **190**(11): 592–596. https://doi.org/10.1038/sj.bdj.4801046

Ninou S, Stephens C (1994). The early treatment of posterior crossbites: A review of continuing controversies. *Dent Update*, **21**(10): 420–426.

Piassi E, LS Antunes, MRTC Andrade, LAA Antunes (2016). Quality of life following early orthodontic therapy for anterior crossbite: Report of cases in twin boys. *Case Rep Dent*, **2016**: 3685693. https://doi.org/10.1155/2016/3685693

Prakash P, Durgesh BH (2011). Anterior crossbite correction in early mixed dentition period using Catlan's appliance: A case report. *ISRN Dent*, **2011**: 298931. https://doi.org/10.5402/2011/298931

Sockalingam SNMP, Khan KAM, Kuppusamy E (2018). Interceptive correction of anterior crossbite using short-span wire-fixed orthodontic appliance: A report of three cases. *Case Rep Dent*, **2018**: 4323945. https://doi.org/10.1155/2018/4323945

Sunil MM, Zareena MA, Ratheesh MS, Anjana G (2017). Early orthodontic interception of anterior crossbite in mixed dentition. *J Int Oral Health*, **9**(2): 88–90. https://doi.org/10.4103/jioh.jioh_9_17

Thilander B, Myrberg N (1973). The prevalence of malocclusion in Swedish schoolchildren. *Scand J Dent Res*, **81**(1): 12–21. https://doi.org/10.1111/j.1600-0722.1973.tb01489.x

Thilander B, Rubio G, Pena L, de Mayorga C (2002). Prevalence of temporomandibular dysfunction and its association with malocclusion in children and adolescents: An epidemiologic study related to specified stages of dental development. *Angle Orthod*, **72**(2): 146–154. https://doi.org/10.1043/0003-3219(2002)072<0146:POTDAI>2.0.CO;2

Valentine F, Howitt JW (1970). Implications of early anterior crossbite correction. *ASDC J Dent Child*, **37**(5): 420–427.

Vithanaarachchi SN, Nawarathna LS (2017). Prevalence of anterior cross bite in preadolescent orthodontic patients attending an orthodontic clinic. *Ceylon Med J*, **62**(3): 189–192. https://doi.org/10.4038/cmj.v62i3.8523

Wiedel AP, Bondemark L (2014). Fixed versus removable orthodontic appliances to correct anterior crossbite in the mixed dentition: A randomized controlled trial. *Eur J Orthod*, **37**(2): 123–127. https://doi.org/10.1093/ejo/cju005

Wiedel AP, Bondemark L (2015). Stability of anterior crossbite correction: A randomized controlled trial with a 2-year follow-up. *Angle Orthod*, **85**(2): 189–195. https://doi.org/10.2319/041114-266.1

Wilmott SE, Ikeagwuani O, McLeod NM (2016). An orthodontic bracket embedded in the medial pterygoid surface: A case report. *J Orthod*, **43**(1): 65–67. https://doi.org/10.1179/1465313314Y.0000000113