

Correction of Single-Tooth Crossbite Using a 2x4 Appliance: A Clinical Case Report

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Abstract: *The 2x4 appliance offers a versatile treatment option, featuring bands cemented or bonded to the first permanent maxillary molars and brackets affixed to the labial surfaces of the maxillary incisors. A continuous archwire passes through the buccal tubes of the molar bands and engages the incisor brackets. This setup provides full control over the anterior teeth, enabling precise and efficient repositioning. Requiring minimal adjustments, the appliance is well-tolerated by patients and supports faster treatment completion. This case report describes the correction of a single-tooth anterior crossbite using the 2x4 appliance.*

Keywords: 2x4 appliance, Single Tooth Crossbite, Mixed Dentition

1. Introduction

The transition from primary to permanent dentition often leads to malocclusion due to multiple factors, with the mixed dentition phase being the most critical. Early intervention during this period can correct occlusal discrepancies and promote normal dental and jaw development. Timing and type of treatment in this transitional stage remain controversial. Among the most common issues in mixed dentition, anterior crossbite stands out.

Anterior crossbite refers to an abnormal labiolingual reversal in the relationship between one or more teeth and their antagonists. Early interception and treatment are essential, as this condition is self-perpetuating; without prompt intervention, it may progress to skeletal malocclusion, potentially necessitating extensive orthodontics and surgery. Various treatment modalities for correcting anterior crossbite include tongue blade therapy, Hawley retainers with auxiliary springs, lower inclined planes, stainless steel or composite crowns, and labial or lingual archwires. Removable appliances pose challenges due to poor patient compliance with wear and adjustments; without cooperation, treatment fails. Achieving such compliance can be particularly difficult in pediatric patients.

The 2x4 appliance used in the mixed dentition is a flexible orthodontic device comprising bands on the first permanent molars and bonded brackets on the erupted maxillary permanent incisors. A continuous archwire is employed to provide comprehensive control over the arch form. The 2x4 technique enables precise regulation of force, magnitude, and

direction for anterior tooth movement in all three dimensions- bodily (translational) movement, tipping, root torque, and rotation- while also maintaining the arch shape effectively.

This appliance offers predictable treatment outcomes within a relatively short time frame for complex occlusal problems such as crossbites, ectopically erupted or impacted maxillary central incisors, and anterior crowding with misaligned teeth (including mild rotations, midline diastemas, abnormal spacing, and improper axial angulation). The 2x4 appliance can be placed and removed easily during the mixed dentition phase, is cost-effective, comfortable, well tolerated by patients, and requires minimal cooperation from the child.

Therefore, the present case report highlights the correction of a single-tooth anterior crossbite using a 2x4 appliance.

2. Case Presentation

A 11-year-old boy presented at the Department of Pediatric and Preventive Dentistry with a primary concern of malaligned teeth in the upper anterior region. There was no significant family or medical history. Also, there was no history of any habits. Intraoral examination revealed that the patient was in the mixed dentition phase of occlusion and the maxillary right central incisor was positioned palatally, leading to an anterior crossbite. Cephalometric and model analyses were carried out to arrive at the diagnosis of Angle's class 1 malocclusion with anterior crossbite in relation to tooth number 21.



After discussion of the treatment options with the patient's parents, informed consent was obtained. To initiate treatment, orthodontic molar bands with buccal tubes were cemented on the maxillary first molars bilaterally. Subsequently, metal brackets, MBT system 0.022" slot, were bonded to the labial surfaces of the four maxillary permanent incisors. A 0.014" round nickel-titanium (Ni-Ti) archwire was inserted into the bracket slots and engaged in the molar tubes bilaterally. Light cure composite [Waldent Blue Bite} buildup of 2 mm was used as posterior bite ramps on the mandibular permanent molars bilaterally. It is ideal for creating a bite ramp due to its temporary nature and ease of removal once the treatment

is finished. This was done to disocclude the occlusion and thereby achieve a 2 mm incisal clearance. The archwire was stabilized in position using elastic modules and the patient was recalled after one month since ideally tooth movement is achieved within 4-5 weeks. After a period of one month, the 0.016" round Ni-Ti archwire was changed to 0.016 x 0.022" Ni-Ti rectangular wire and retained for another month before the brackets were debonded. After debonding, the anterior crossbite was successfully resolved with the four maxillary incisors aligned in their correct positions without any disruption to the occlusion.



A 0.014" round nickel-titanium (Ni-Ti) archwire was inserted into the bracket slots and engaged in the molar tubes bilaterally. Glass ionomer cement (GIC) buildup of 2 mm was used as posterior bite ramps on the mandibular

permanent molars bilaterally. GIC is ideal for creating a bite ramp due to its temporary nature and ease of removal once the treatment is finished. This was done to disocclude the occlusion and thereby achieve a 2 mm incisal clearance



3 Months Follow Up



6 Months Follow Up

3. Discussion

Removable appliances have been proposed as an effective approach for correcting anterior tooth malposition, resolving teeth in lingual crossbite, and addressing constricted maxillary arches. Removable appliances present certain limitations, primarily due to their limited control over tooth positioning. They typically apply single-point forces, often resulting in simple tipping movements rather than precise tooth movement. Additionally, patients may frequently remove and reinsert the appliance, leading to stress fractures in the retaining cribs or clasps, compromising retention. This loss of retention can result in reduced compliance, as patients may be inclined to discontinue use.

The advantages of using the 2×4 appliance include minimal reliance on patient cooperation, reduced treatment duration, absence of laboratory costs, and the ability to facilitate versatile orthodontic tooth movements and corrections. MBT brackets are incorporated with ideal tip and torque values ensuring that the teeth are placed in the correct axial inclination. The orthodontic wires employed in the 2 × 4 technique must be thin in diameter to appropriately provide light, continuous and well-controlled forces over the incisors. These light orthodontic forces are applied for incisor derotations, alignment, and leveling, and are considered clinically safe and effective; according to the identified literature, initial archwires can be “0.012” to “0.016” NiTi (Nickel-Titanium alloy or Nitinol) (Titanium Molybdenum-Titanium Alloy (TMA) wires can also be used); in a second phase, “0.016” stainless steel wires are employed; and finally, rectangular wires (“0.017” or “0.018” × “0.025”) are placed. These arch wires are changed every two to four

weeks¹². It is used in the correction of anterior crossbite¹³, mild to moderate rotations in anterior teeth¹⁴, mild proclination correction, and space closure¹⁵, helps in space regaining when used along with springs, and helps in repositioning the unerupted permanent teeth¹⁶.

4. Conclusion

The 2 × 4 appliance is a versatile and effective option for patients with mild to moderate malocclusions in the mixed dentition stage. This fixed orthodontic device utilizes light, continuous, and well-controlled forces. It can be utilized in various clinical situations with minimal modifications and only a few drawbacks compared to traditional removable approaches. The 2 × 4 appliance has been well-documented for its clinical efficacy in early orthodontic management of common malocclusions such as incisor crowding or rotations, orthodontic extension, anterior and posterior crossbites, ectopic eruption of upper incisors, and midline diastemas.

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