Case Report
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Orthodontic Management of a Severely Rotated Maxillary Central Incisor with a Modified Whip Appliance in Mixed Dentition Period

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Objectives Tooth rotation is one of the most prevalent dental anomalies. Early management of rotated teeth would prevent possible occlusal interferences. The purpose of this case report was to introduce a fixed-removable appliance, which can efficiently correct severely rotated anterior teeth in a short duration of time in mixed dentition period.
Case A 7-year-old boy with a Class I malocclusion was referred to the Orthodontics Department, School of Dentistry at Kerman University of Medical Sciences with the chief complaint of severe rotation of one of his maxillary central incisors. A whip appliance, which included a removable orthodontic appliance, a cantilever spring (whip) and a bonded tube, was used to treat this rotation. After 4 weeks, the upper right central incisor was aligned and overcorrected completely. A circumferential supracrestalfibrotomy was performed to prevent relapse.
Conclusion In the present case, we treated a severely rotated central incisor in a short duration of timeusing the whip appliance. This appliance can be utilized effectively in emergency situations such as traumatic occlusion of central incisors.
Keywords Dentition; Mixed; Rotation; Dental Occlusion; Traumatic; Orthodontic Appliances

Introduction

Tooth rotation as a type of tooth malalignment is defined as observable mesiolingual or distolingual intra-alveolar displacement of a tooth around its longitudinal axis.[1, 2] The exact etiology of tooth rotation is unknown.[3, 4] Rotation of permanent teeth can be due to pre-eruptive disturbances such as tooth bud displacement and mesiodense, or because of post-eruptive disturbances, such as habitual, mechanical, local, or environmental factors.[5-7] Early management of rotated teeth may prevent occlusal interferences, irreparable injuries to the supporting tissues, and dental follicle transposition. It also improves dental esthetics and subsequently the child's self-confidence.[8] Severe and multiple rotations should be corrected by using a fixed appliance[9], but a rotated upper incisor in the mixed dentition can be corrected with a removable appliance with minimal force.[9, 10] Higher cooperation of patient, improved oral hygiene, better anchorage control and simple force application system are some of the advantages of a removable appliance.[4, 10]

The whip appliance was introduced by Houston and Isaacson in 1980.It is a semi-removable appliance that consists of an acrylic plate, a cantilever spring and a bracket or bonded tube that enables effective correction of severely rotated anterior teeth in a short period of time.[11]

The purpose of this case report is to introduce an effective fixed-removable appliance for early management of severely rotated anterior teeth in the mixed dentition period.

Case

A 7-year-old boy was referred to the Orthodontics Department of Kerman University of Medical Sciences with the chief complaint of severe rotation of one of his maxillary central incisors. The medical history of the patient revealed no problem. Extraoral examination showed a mild convex profile and lip competency. In frontal view, he was mesoprosopic. The intraoral clinical examination revealedclass I molar relationship with about 85° rotation of the right maxillary central incisor and a space deficiency for the eruption of maxillary right lateral incisor. The patient had a mild class II skeletal relationship but did not have vertical problem. In radiographic examination, completion of ¾ of the root was confirmed, and no pathology such as supernumerary teeth or odontoma was observed (Figure 1a,b, Figure 2). No history of trauma was reported by the parents. The patient underwent extraction of the right primary lateral incisor that was mobile before the onset of treatment.

Figure 1a-Pretreatment extraoral photographs

Figure 1b- Pretreatment intraoral photographs

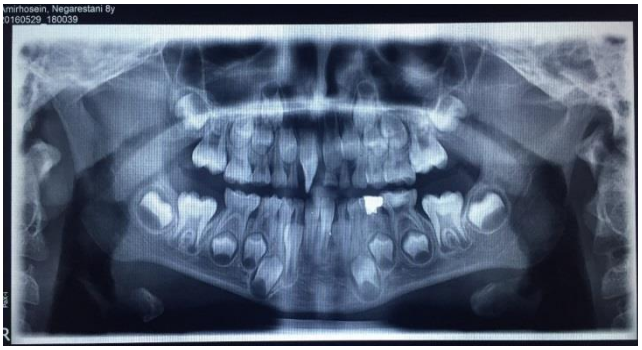

Figure 2- Pretreatment panoramic radiograph

In this treatment modality, the early orthodontic treatment was carried out in one phase with the following aims: alignment of rotated central incisor and space management for eruption of lateral incisor, preventing irreparable injuries to the supporting tissues due to trauma from occlusion and improvements in the patient's profile and self-image.

Panoramic radiograph and photographs were obtained. After obtaining informed consent from the parents, an alginate impression was made. A whip appliance was fabricated on the working cast.The device included a removable orthodontic appliance, a cantilever spring (whip) and a bonded tube. The removable appliance was made of acrylic base plate, circumferential clasps on the upper primary canines and Delta and Adam's claspson the upper primary second molar and first permanent molar(10).A tube (Dentaurum, Germany) was bonded to the labial surface of the central incisor with light-cure composite resin (Trans Bond XT, 3M Unitek, USA).To increase the flexibility and range of motion, the whip spring was fabricated by bending two vertical loops at the distal of canines and right at the distal of molar tube into a 14 mm stainless steel wire (Figure 3).

Vertical loops were formed by upward bending ofa 14 mm stainless steel wire at first and then immediately bending it downwards at its end. The mesial end of the spring was inserted into the tube slot and bent towards the gingiva, and the hook located in the distal end of the wire was engaged to the delta portion of the clasps between the upper primary second molar and permanent first molar(Figure 3).

Instructions for use of the appliance were given to the patient's parents, and he was asked to use it 24 hours a day even during meals except for oral hygiene.

The patient was visited during routine orthodontic adjustment visit after4 weeks.The tooth was aligned and overcorrected completely during a short period of 4 weeks (Figure 4a, b).

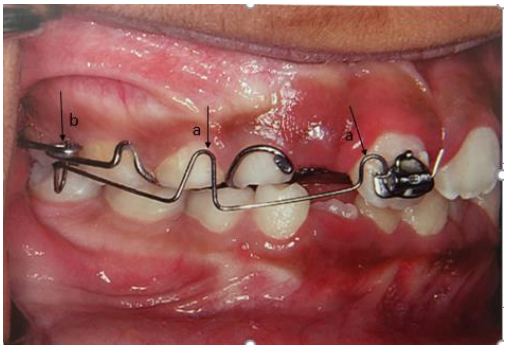

Figure 3:(a) Whip spring was fabricated by bending two vertical loops into a 14 mm stainless steel wire; (b) the hook located in the distal end of the wire was engaged to the delta portion of the clasps between the upper primary second molar and permanent first molar.

Figure 4a- Post-treatment extraoral photographs

Figure 4b: Post-treatment intraoral photographs: distal end of the wire was engaged to the delta portion of the clasps between the upper primary second molar and permanent first molar

Figure 5-Post-treatment panoramic radiograph

After overcorrecting the tooth rotation, a periodontist performed circumferential supracrestalfibrotomy to prevent relapse. One month after fibrotomy, a finger spring was added to the appliance to tip the central incisor mesially and facilitate eruption of lateral incisor after space regaining.

Finally, the appliances were removed, and the retention phase was started by a modified Hawley retainer with an acrylic bar on its labial bow. The patient was asked to wear the retainer appliance for 6 months. Then, a 6-month follow-up appointment was set.

At the time of appliance removal, the rotated tooth was aligned; the dental status was normal for his age. Post-treatment panoramic radiograph showed no contact between the lateral crown and central incisor root (Figure 5).

Discussion

Tooth rotation is considered subjectively as any evident mesiolingual or distobuccal intra-alveolar displacement of tooth around its longitudinal axis.[12] Although the etiology is clearly unknown, dental follicle displacement and path of tooth eruption can be the possible causes.

In the present study, a patient with severe rotation of maxillary incisor was treated by a whip appliance. The conventional method for correction of tooth rotation is to use a fixed appliance in the mixed dentition period. This typical appliance is formed in 2×4 or 2×6 arrangement.

Although this method can correct all kinds of rotations, but it has some problems. In the mixed dentition period, the present permanent teeth are grouped in the anterior (incisor) and posterior (molar) segments. Thus, a fixed appliance anchors only to a few teeth instead of all the permanent teeth. Lateral incisors have usually not erupted yet. When a fixed appliance includes only some of the teeth, arch wire spans are longer, large moments are easy to create, and the wire themselves have more springiness and are less strong. In this situation, the possibility of breaking, distortion and displacement of the wire is higher, while the wire in the whip appliance is 14 mm stainless steel with higher stiffness. In addition, since only first molars serve as an anchorage unit in the posterior segment, anchorage control in this method is difficult and more critical. However, with the whip appliance, a good anchorage unit is provided from the entire palate and the maxillary dentition. Another disadvantage of the fixed appliance is difficulty in oral hygiene that can lead to decalcification of banded and bonded teeth.[10, 13] Furthermore, frequent debonding of attachments in fixed appliance may prolong the course of treatment. Another alternative appliance for treatment of mild tooth rotation is a removable appliance with a labial bow and a palatal spring like Z-spring, which provides coupled forces to derotate the tooth. Anchorage control in this method is not a problem, but this device is unable to correct severe rotations. To correct a severely rotated central incisor in the mixed dentition period, the whip appliance has several advantages as follows:

1. Solving the problem in the mixed dentition period in a relatively short time.[14] This improves patient's self-image by enhancing smile esthetics during the preadolescent years.
2. Anchorage control is less critical.
3. Force system is relatively simple.
4. Oral hygiene management is easier.
5. Patient cooperation is less critical. This is because of patient discomfort. The distal end of the whip spring will be inserted into the mucosa if the patient removes the appliance from the mouth.

Problems that may be encountered during treatment are debonding of the bracket and distortion of the spring. Moreover, extrusion and slight labial tipping of upper incisors may occur during treatment.[15] The mucosa may be irritated if the whip spring is not adjusted carefully.

An important sequela with the use of whip appliance is unwanted mesiodistal crown and root movement. It may occur if the spring is activated in the vertical plane.[9]

Previous studies, similar to this report, did not observe any harmful side-effect on root development.[1, 10] Delayed treatment of a rotated permanent incisor may lead to dilacerations of the developing roots, root resorption, loss of tooth vitality and compromised oral hygiene.[16] It seems advisable to initiate orthodontic correction of the incisors at a young age during the mixed dentition period.

Derotated teeth are prone to relapse due to stretching of the supra-alveolar and transseptal gingival fibers, which readapt very slowly to the new position. Thus, they must be overcorrected and circumferential supracrestal fibrotomy should be performed at the end of treatment. Long-term retention is required to achieve optimal stability of treatment.

Conclusion

The whip appliance is a fixed-removable appliance, which could efficiently correct severely rotated anterior teeth, such as the maxillary central incisor in a short duration of time in the mixed dentition period even in emergency situations such as traumatic occlusion of central incisors.

Conflict of Interest

Non Declared ■

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