Case Report

Hybrid Rapid Palatal Expansion With 2 Mini-Screws: A Case Report

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ABSTRACT
A hybrid expander is a newly designed bone-anchored expander consisting of 2 mini-screws and palatal acrylic; it does not cover any teeth. The aim of this case report is to present the treatment of a patient with transversal maxillary deficiency by hybrid expander. An 11.4-year-old female patient came to our clinic complaining about the appearance of her teeth. She had a narrow maxillary arch, unilateral dental crossbite, anterior dental crowding, and dental Class II canine and molar relationships on both sides. Two self-tapping mini-screws were placed between the first molar and second premolar on the palate under minimal local anesthesia. After 1 week, this appliance was bonded to the mini-screws with Transbond XT (3M Unitek, Monrovia, CA, USA) resin. The expansion screw was activated twice a day for 1 week and then once a day until the expansion was completed. After the expansion period, the brackets were bonded to the teeth without removing the hybrid expander. Sufficient maxillary expansion had been achieved without buccal tipping of the posterior teeth, and the midline diastema had closed spontaneously. This newly designed hybrid expander was efficient in correcting a transverse maxillary deficiency without any of the side effects found with conventional rapid maxillary expanders. The most important advantage of this appliance is that clinicians can implement expansion and bonding procedures at the same time. (*Turkish J. Orthod*. 2015;28:64–70)

KEY WORDS: Bone-borne expansion, Rapid maxillary expansion

INTRODUCTION

Throughout the years, rapid maxillary expansion (RME) has been widely used by many orthodontists to increase the maxillary transverse size in young patients, and many types of palatal expanders and their effects on facial structures have been studied.[1] The RME technique, which was first described in the literature in 1860 by Angell,[2] is an important orthopedic treatment procedure in cases of transverse maxillary deficiency and posterior crossbite.[3] It has been widely popular since it was implemented by Haas[4] in 1961.

Conventional appliances, such as the Haas, Hyrax, cap splint, and Minne expanders, and recently developed acrylic bonded RME appliance are samples of RME appliances.[5] Traditional appliances, such as tooth-borne palatal expanders (the Haas or Hyrax appliance) have many disadvantages, such as buccal root exposure of anchor teeth, periodontal problems, buccal root resorption, dentoalveolar tipping and/or buccal bone dehiscence, and poor oral hygiene.[6]

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Bone supported RME devices are a good option to overcome the detrimental effects of traditional tooth-borne RME. Bone-borne devices transmit the expansion forces directly to the palatal bone, thus providing parallel expansion of the palatal halves and tooth tipping as well as minimizing the related complications.[7,8]

Self-tapping mini-screws have been widely used as orthodontic anchorage devices. Mini-screws require the preparation of a pilot cavity before insertion.[9] A hybrid expander designed by Akin *et al,*[10] consists of 2 mini-screws and palatal acrylic and does not cover any teeth.

The aim of this case report is to present the treatment of a patient with transversal maxillary deficiency using a hybrid expander.

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Figure 1. Intraoral and extraoral photographs at the beginning of treatment.

CASE REPORT

Patient History and Diagnosis

An 11.4-year-old female patient came to our clinic complaining about the appearance of her teeth. In the extraoral examination of this patient, she was found to have an equable and symmetric face and buccal corridors while smiling. She had a convex profile (ANB = 4,6°), decreased nasolabial angle (110,3°), and increased vertical proportions (FMA = 31,6°). Intraoral examination revealed a narrow maxillary arch, unilateral dental crossbite, anterior dental crowding, and dental Class II canine and molar relationships on both sides. Overbite was deep, with the maxillary incisors overlapping the mandibular incisors by 50%. Anterior overjet was 3.5 mm. Her maxillary midline coincided with the facial midline, and the mandibular midline was shifted 2.5 mm to the right. There was 3.1 mm crowding in the maxillary arch and 3.8 mm crowding in the mandibular arch (Fig. 1). The frontal cephalometric examination revealed a maxillary width of 59 mm, a right maxillomandibular width of −13.8 mm, and a left maxillomandibular width of −12.3 mm. The maxillary basal bone was skeletally narrow. The patient had no systemic diseases, no negative oral habits, and no temporomandibular joint symptoms.

Treatment Objective and Plan

The orthodontic treatment plan included the use of a hybrid expander to the maxilla. After the maxillary expansion, all teeth were bonded without removing the hybrid expander; we planned to level the maxillary and mandibular arches and obtain Class I molar and canine relationships.

Treatment Alternatives

Treatment alternatives for the expansion of maxilla are the use of conventional appliances, transpalatal arch, or quad helix. However, we preferred not to use any of these treatment alternatives as they may cause demineralization,

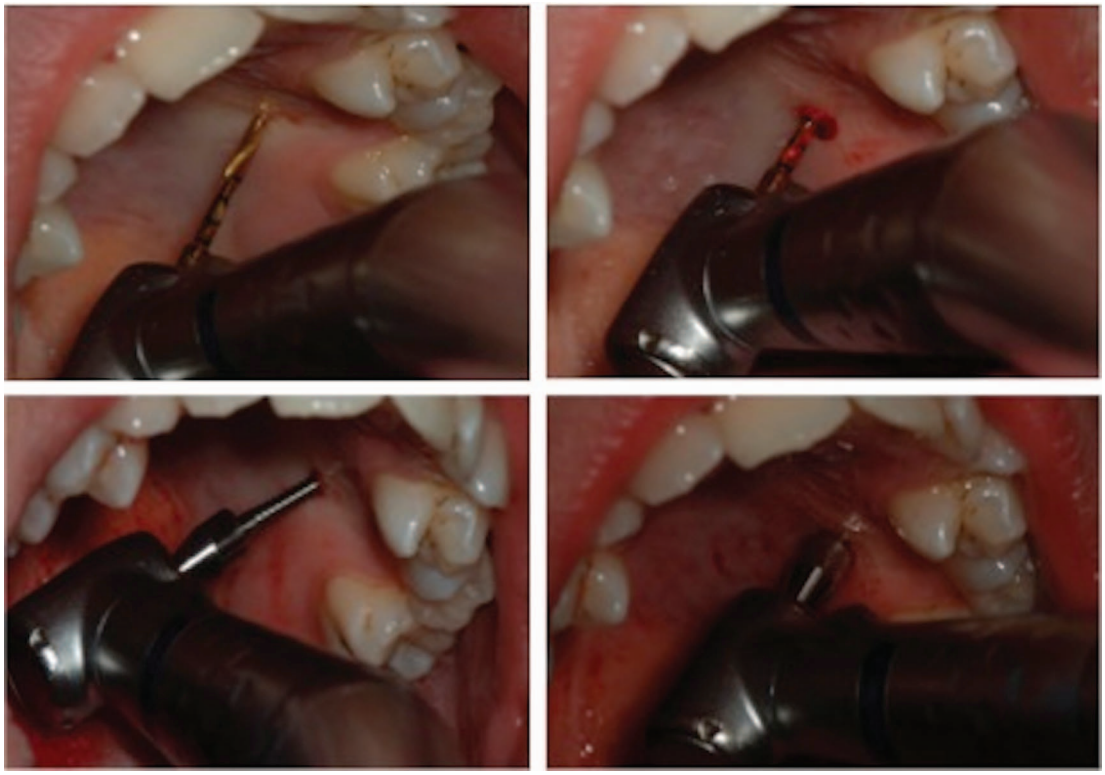

Figure 2. Appliance design on the dental cast.

especially in posterior teeth. The most disadvantageous results of transpalatal arch are tipping in posterior teeth and inadequate expansion. We did not use quad helix because of concern about patient discomfort from problems such as injuries to the tongue. In addition, this patient needed skeletal expansion to reduce distinct buccal corridors and enhance the esthetics of her smile.

Appliance Design

Soft tissue thickness was measured using a dental probe under minimal local anesthesia to determine an area with thin mucosa coverage on hard palate. It is important to obtain sufficient primary stability.[11] Two self-tapping mini-screws (Excalibur, SIA, Caserta, Italy) (1.6 mm in diameter, 10 mm in length and containing 3 mm soft tissue thickness) were inserted bilaterally between the upper second premolars and first molars on the palate at 45° (Fig. 2). At the first appointment, an impression of the upper jaw was taken using alginate (Kromopan, Lascod, Italy).

A dental cast was obtained, and we used mini-screw points on this model. A Hyrax screw (G&H Orthodontics, Franklin, Indiana, USA) was adapted as deep as possible on the midline of the palatal vault. Then the arms of the Hyrax screw were bent on the cast in the laboratory. The mini-screws were placed in the middle of the arms of the Hyrax screw on both sides. Mini-screws were coated with dental wax, and acrylic was added to this screw on the dental cast. The acrylic was 4–5 mm behind the upper central incisors, extending cervically to the premolars and molars and covering the second and third rugae. Finally, the acrylic around the mini-screws was removed (Fig. 3).

A hybrid expander gets support only from the palate and mini-screws and does not cover any teeth. That makes this appliance more hygienic than tooth-borne palatal expanders.

Treatment Progress

After cementation of the hybrid expander, the clinician turned the Hyrax screw first and then instructed the patient's parents on how to turn the screw and activate the expansion appliance with a swivel key. The patient was instructed to use orthodontics Essix plaque all day, except when eating, to open the bite. The appliance was activated with a quarter turn ($2 \times 1/4$ turn $= 0.5$ mm) twice per day during the first week to overcome the resistance of the sutures (Fig. 4), and then a quarter turn once per day was applied until 2–3 mm overexpansion (overcorrection) was obtained after the midpalatal

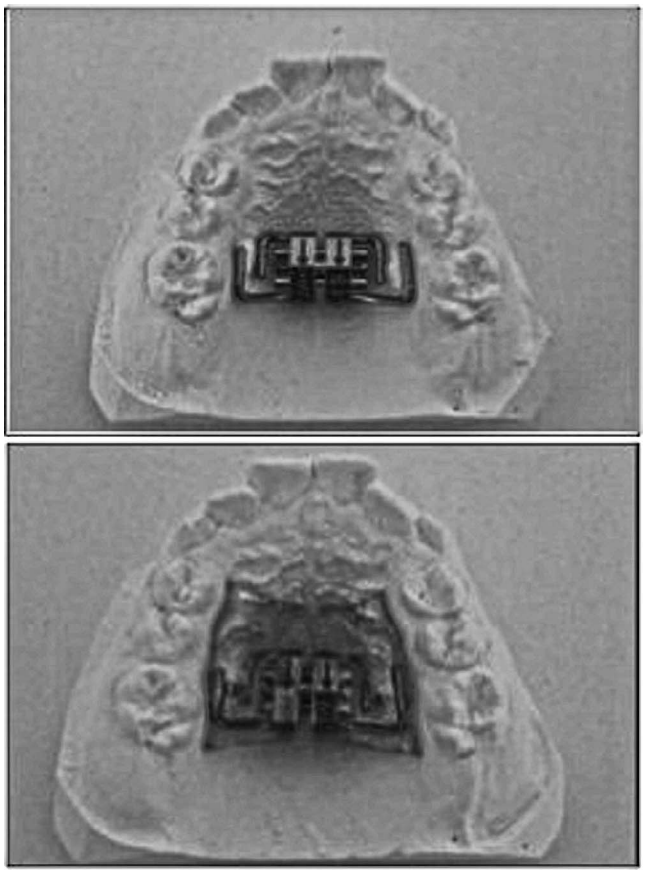

Figure 3. Placement of the mini-screw used for rapid maxillary expansion.

suture had opened (utilizing radiography). The total expansion period took 4 weeks.

After the expansion period, a stainless steel ligature wire was tied around the Hyrax screw, and the brackets were bonded to the teeth without removing the hybrid expander (Fig. 5). In this manner, the retention phase took place at the same time as the leveling process.

Treatment Results

At the end of 14 months of orthodontic treatment, the maxillary width was increased (from 59 mm to 68 mm), the maxillary and mandibular arches were leveled, and Class I molar and canine relationships were established on both sides. The midlines of the maxillary and the mandibular teeth coincided. Normal overjet and overbite were obtained (Figs. 6 and 7). Palatal soft tissue irritation was not evident around appliances.

DISCUSSION

Many RME appliances have been described, such as tooth-tissue borne (Haas type) and tooth-borne

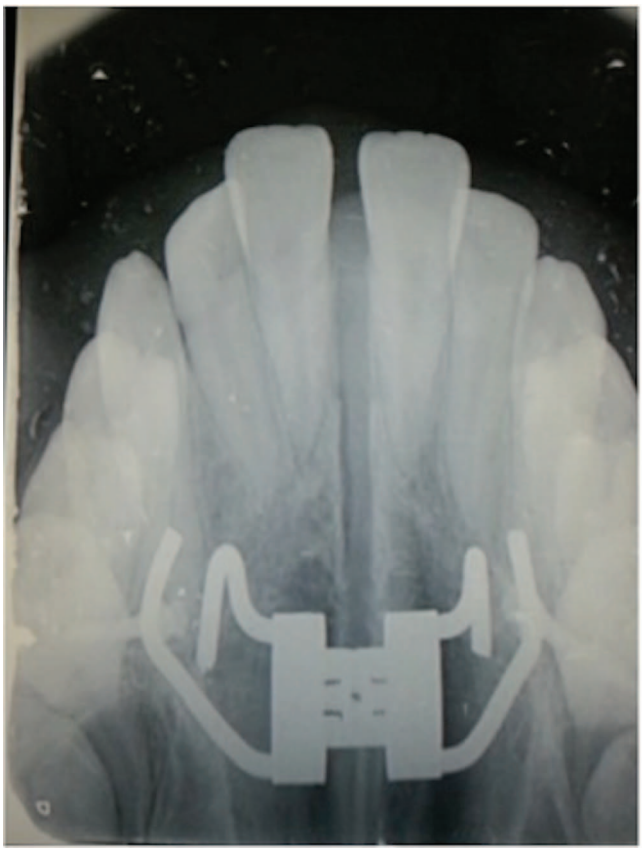

Figure 4. Upper occlusal radiograph taken after 1 week.

(Hyrax type) devices.[12] Acrylic pads are added on the palatal vault in Haas type RME to reinforce anchorage for maximum skeletal response. In contrast, there are no acrylic pads in the design of Hyrax-type RME, so this appliance is more hygienic and does not cause soft tissue irritation under the acrylic plate.[4,13,14] As with the differences between the design of Haas type and Hyrax type, there is no

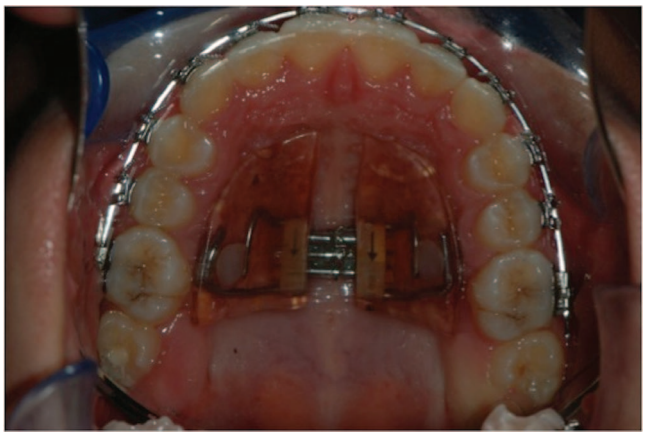

Figure 5. Hybrid expander as retention appliance after expansion was completed.

Figure 6. Intraoral and extraoral photographs at the end of treatment.

consensus in the literature about the early effects of these appliances.[12]

Handelman[15] and Baysal et al[16] reported an increase in bone dehiscence, a decrease in thickness and height of the buccal alveolar bone, and gingival recession after tooth-borne RME in young patients with transverse maxillary deficiencies.

The opening of the midpalatal suture with minimum orthodontic movement in RME results in maximum skeletal response by the use of fixed and rigid expanders.[4,17] Traditional tooth-borne palatal expanders, in which a Hyrax expansion screw is soldered to the molar and premolar bands, transmit a large amount of force to the anchor teeth. Therefore, a nonparallel movement of the right and left maxilla as well as several complications, such as pathologic loss of buccal cortical bone, root resorption at the anchorage teeth, dentoalveolar tipping, periodontal problems, and difficulty in providing oral care, have been reported.[6,18] Dental anchorage quality also depends on the position of the maxillary sinus. In cases of maxillary sinus extension far downward, the quality may also be decreased.[18,19] To eliminate these complications, orthodontists have promoted absolute bone-borne RME appliances.[7,8] However, these devices are expensive, and the placement and removal of some kinds of distractors require invasive approaches because of flap operation. In addition, these operations increase the risk of root lesions and infections.[7]

Transpalatal arch is primarily used for mild transversal dental expansion, to change or stabilize the position of the maxillary molars, to stabilize transverse dimension posteriorly during treatment, to maintain leeway spaces during transition of the dentition, and to provide additional anchorage.[20,21] A quad-helix appliance has been routinely used to correct dental crossbites in the early mixed dentition.[22] Previous studies reported that the quad-helix treatment caused the maxillary first molars to be tipped buccally and rotated mesiobuccally.[23,24]

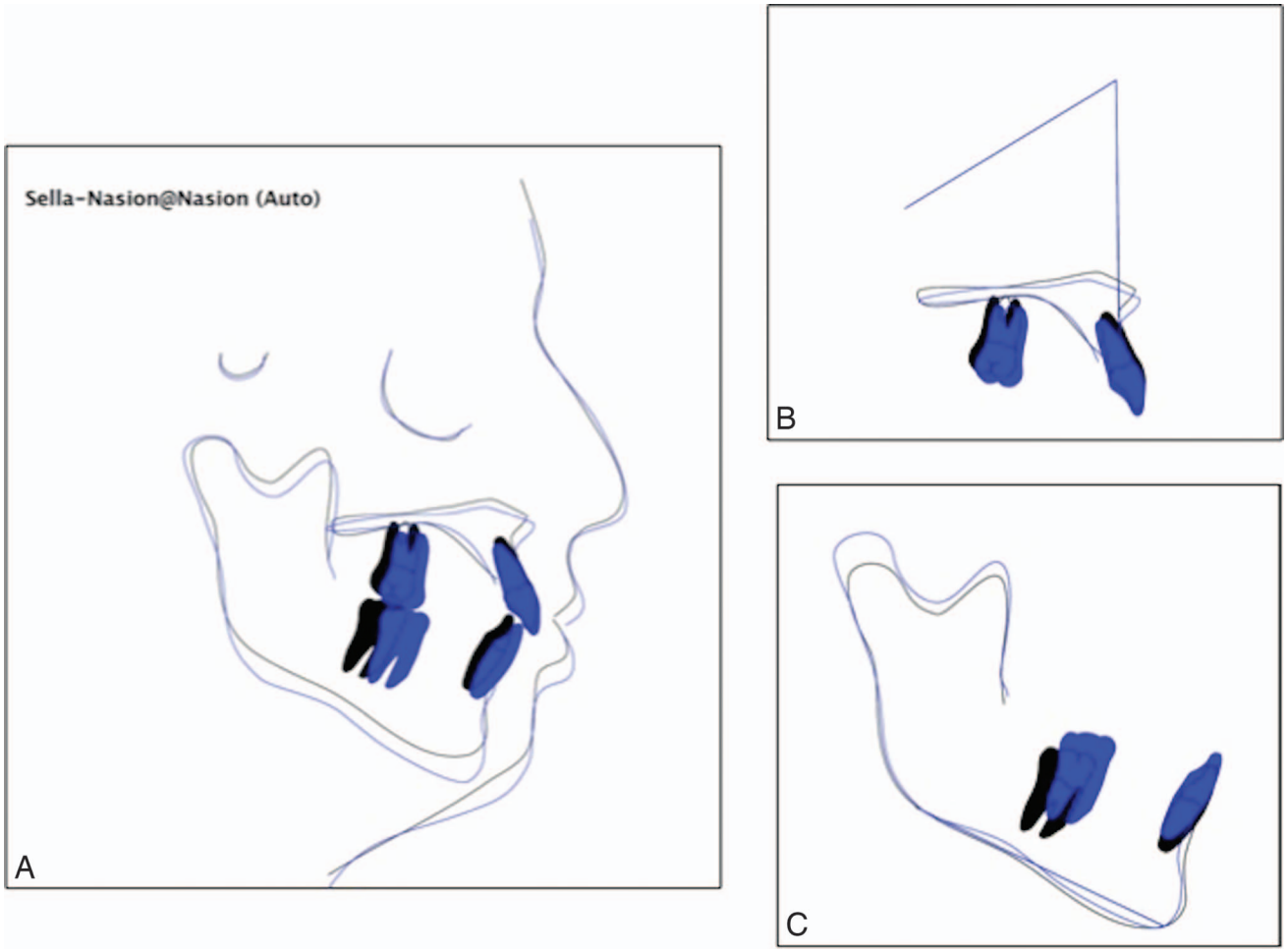

Figure 7. (A) Total superposition on the SN plane. (B) Maxillary local superposition on the nasion-basion plane. (C) Mandibular local superposition on the corpus left-menton plane.

Mini-screws are becoming increasingly common as an absolute anchorage device because they are easy to insert and remove and are inexpensive. The small size of the mini-screws provides easy insertion into the bone between the roots of teeth, thereby requiring a less traumatic procedure.[25] Self-tapping mini-screws are often used for this reason. This mini-screw requires a pilot cavity to be prepared before insertion. The pilot cavity is prepared with a drill that has a minimum diameter equal to the core of the screws.[9,26] The use of self-tapping mini-screws is surgically minimally invasive compared with pure bone-borne devices, such as distractors.[7,8]

To date, mini-screw–supported rapid palatal expansion devices have contained a minimum of 2 mini-screws and 2 molar bands soldered to the Hyrax expansion screw.[27,28] Akin et al[10] have designed a new palatal expander that can be used with only 2 mini-screws. This appliance, called a hybrid expander, consists of 2 mini-screws and palatal acrylic. The most significant advantages of the hybrid expander are that it does not cover any teeth, it is easy to insert and remove the mini-screws, and it allows the clinician to implement retention and bonding procedures at the same time. In this way, the patient's oral hygiene is maintained and total orthodontic treatment time may be reduced.

There have been no studies relating to this appliance in the literature. Further studies, however, should be performed to evaluate the effects of the hybrid expander on craniofacial structures, soft tissues, and buccal alveolar bone.

CONCLUSION

Within the limitations of a case report, this newly designed hybrid expander was efficient in correcting transverse maxillary deficiency without any of the side effects seen in conventional rapid maxillary

expanders. This appliance also has advantages such as low cost, minimum patient discomfort, and easy oral hygiene achievement. Thus, the hybrid expander may be preferred instead of traditional tooth-borne expanders.

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