

Maxillary Skeletal Expansion with the Assistance of Ortho Implants: A Clinical Case Report

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ABSTRACT

Introduction: The maxillary skeletal expander (MSE) with the assistance of ortho implants is used to perform rapid palatal expansion in patients who are no longer growing. This case report describes a 15-year-old boy with a bilateral posterior crossbite caused by transverse maxillary deficiency

Methods: A 10-mm MSE was placed with four ortho implants. The MSE was activated once per day for 20 days. Subsequently, a fixed appliance (MBT) was placed as corrective treatment.

Results: An approximate expansion of 8 mm was achieved using the MSE. The posterior crossbite was corrected by increasing the transverse dimensions of the maxilla. An adequate inter-arch relationship similar to the class I molar and canine relationships was achieved, as were a 2-mm overjet and 2-mm overbite.

Conclusions: The use of the MSE with the assistance of ortho implants is an alternative method of treatment that can be beneficial for patients who are no longer growing. This method avoids the use of surgical expansion and is less invasive, more economical, and more comfortable for the patient.

Keywords

Posterior cross bite, Maxillary rapid expansion, Ortho implants

Introduction

Whenever there is an intermaxillary discrepancy in children, the ideal solution is to modify their facial growth by applying force directly to the teeth and indirectly to the skeletal structures. However, some tooth movement and changes in skeletal relationships are inevitable. In some cases, the intermaxillary discrepancy is caused by the different positions and sizes of the upper or lower jaw. This problem involves some dental components, including displacement of the teeth with regard to the supporting bone in one or all planes of the space and/or crowding or spacing in the arches [1,2].

Maxillary disjunction or expansion is an orthopedic treatment that involves the separation of the mid-palatal suture. It was described in 1860 by Angell and introduced to the United States in 1950 by Hass. Several devices and treatment protocols have been developed, but the most common is the rapid maxillary expander [3,4].

Maxillary expansion is usually performed with various types of devices, such as those that rest on the teeth with bands (such as the Hyrax-type appliance), those that are cemented with acrylic tracks on the occlusal surfaces (such as the McNamara appliance), and those that involve a mixture of tooth and palatal gum support (such as the Hass appliance) [3].

All maxillary expansion appliances have been created to achieve the desired orthopedic effect and resolve disjunction; however, they can cause undesirable effects such as vestibularization or inclination of the posterior teeth where the appliance is held, dehiscence, gingival recession, traumatic occlusion, and extrusion of the posterior teeth, thus generating posterior rotation of the jaw and, consequently, an open bite [5].

Currently, mini screw-assisted expansion is performed as an alternative method of applying force directly to the maxilla [5]. One of the appliances available for rapid palatal expansion that is recommended primarily for patients who are no longer growing is the maxillary skeletal expander (MSE), which was developed by Dr. Won Moon and his colleagues at the University of California, Los Angeles (UCLA). The MSE with four ortho implants acts when forces are applied directly to the center of resistance but not directly to the teeth (convictional expansion). This system is more favorable because of the generation of homogeneous force dissipation, which avoids vestibular inclination of the teeth and produces a more parallel suture opening [6].

This clinical case report demonstrates treatment using the MSE with the assistance of ortho implants and conventional orthodontic treatment (MBT).

Case Presentation

A 15-year-old boy presented with a bilateral posterior crossbite caused by a transverse maxillary deficiency. He had a brachyfacial biotype with a straight profile. Initial facial photographs showed a retrusive lip relative to the 6-mm esthetic line (Figure 1). He had a bilateral class I molar relationship and a tendency for class III and bilateral class I canine relationships, 1-mm overjet, 1-mm overbite, and a mandibular midline that deviated 3 mm to the left (Figure 2).

Cephalometric analysis of the lateral skull using radiography showed a class III skeletal pattern (ANB, -2°) caused by retrusion of the maxilla and a vertical growth pattern. The SNA angle was 78° , and the SNB angle was 80° . The angle between the maxillary incisor and SN plane was 103° . The angle between the mandibular incisor and mandibular plane was 82.5° . The interincisal angle was 136° (Figure 3 and Table 1).

For this patient, the treatment objectives were as follows: correct the transverse deficiency of the maxilla with maxillary expansion, thereby expanding the SNA angle; maintain the jaw size along with the SNB angle; correct the bilateral posterior crossbite with transverse maxillary expansion and coordinate the arches; obtain ideal molar class I and bilateral canine class I relationships; obtain

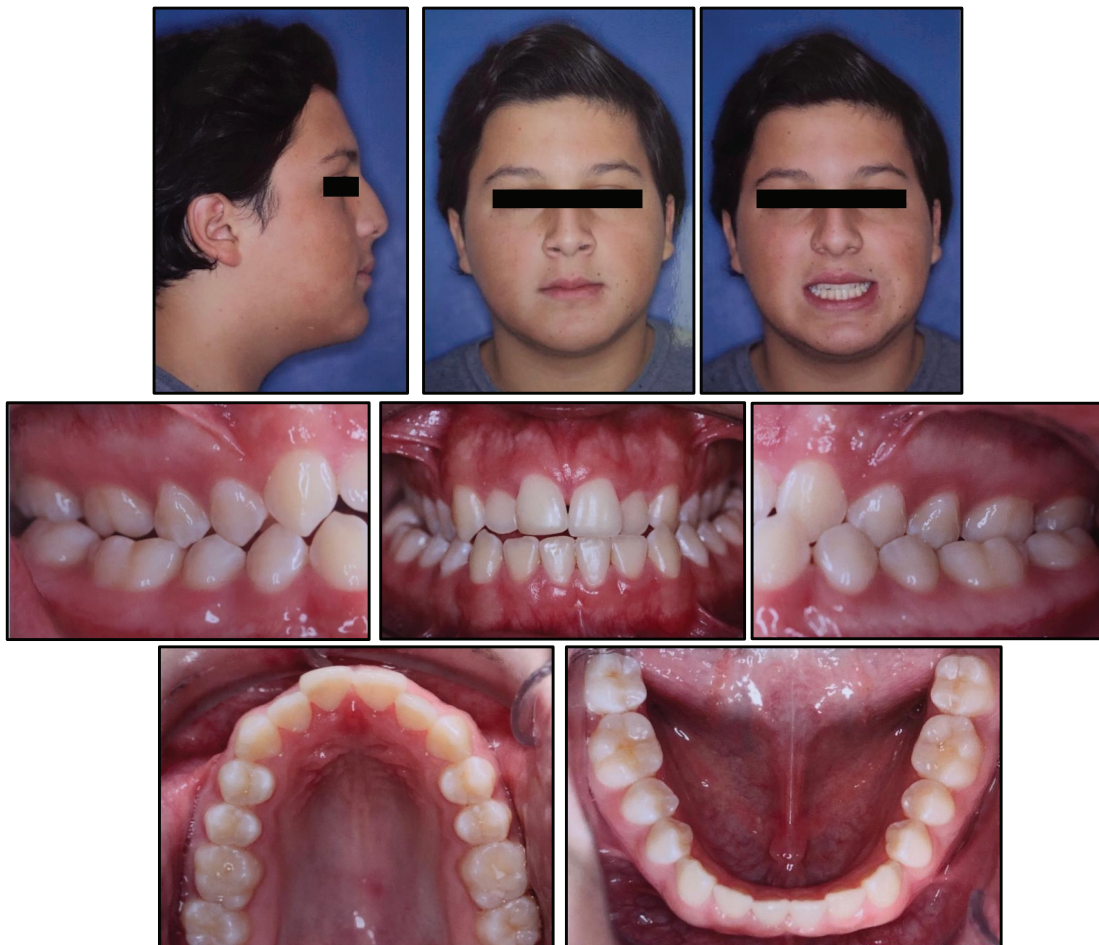


Figure 1: Photographs of the patient before extraoral and intraoral treatment.



Figure 2: Photographs of the study models before treatment.

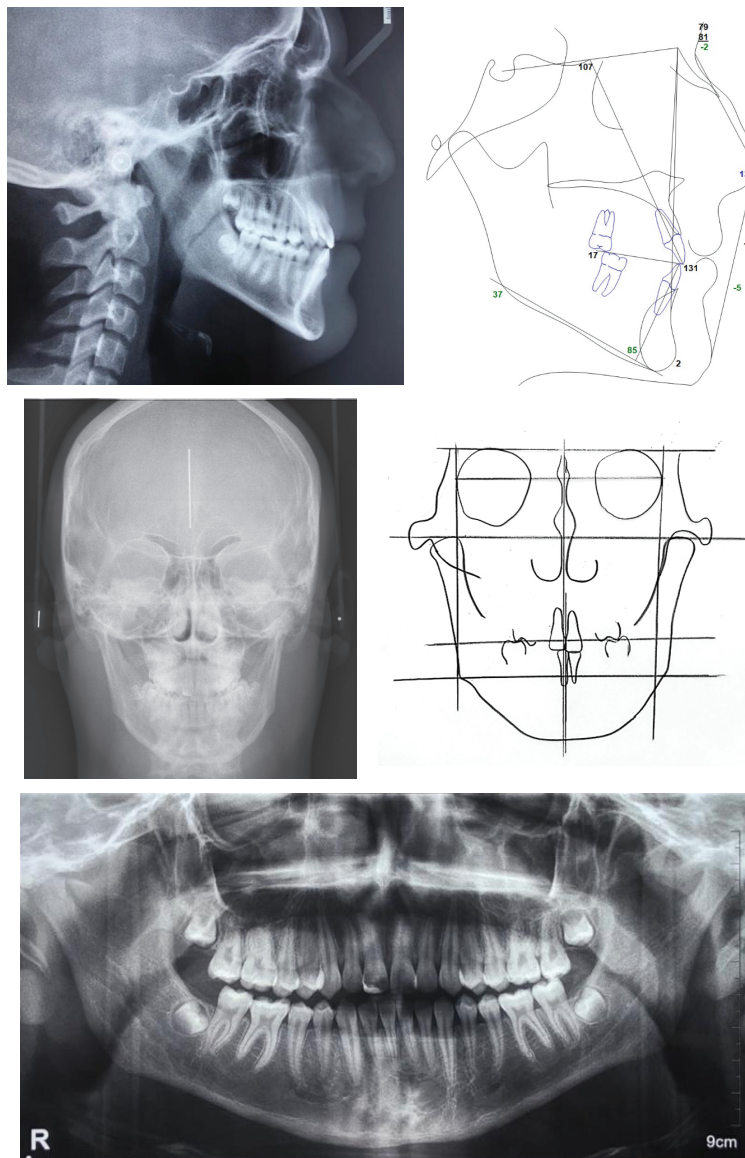


Figure 3: X-ray images of the lateral, anteroposterior, and panoramic views before treatment.

an overjet of 2 mm and an overbite of 2 mm; and correct the maxillary and mandibular deviated midline.

Table 1: Cephalometric comparison of the initial and final records.

Measurement	Initial	Final	Difference
SNA	79°	79°	0°
SNB	81°	80°	-1°
FMA	37°	35°	-2°
ANB	-2°	-1°	-1°
UI to NA	7 mm	5 mm	-2 mm
UI to SN	107°	107°	0°
LI to NB	2 mm	1.5 mm	-0.5 mm
LI to Go-Gn	85°	85°	0°
Esthetic line	-7 mm	-7 mm	0 mm

Expansion in adolescents is a complex procedure. It can be classified as unpredictable and high-risk because of the potential for secondary effects such as reductions in the height and thickness of the alveolar bone, bone dehiscence, and gingival recession. Therefore, surgically assisted rapid palatal expansion (SARPE) is often indicated for these patients to increase the predictability of expansion and reduce side effects [6].

One of the SARPE techniques consists of LeFort I osteotomy, which is associated with surgical rupture of the mid-palatal suture and reduction of the mechanical resistance to lateral forces that are applied by Hyrax expanders. However, this procedure requires hospitalization and general anesthesia, thus increasing the costs and creating fear for the patients [6].

A 10-mm ortho implant and MSE device (BioMaterials Korea, Seoul, South Korea) were placed and activated once per day for 20 days, resulting in an approximate expansion of 8 mm (Figure 4). Subsequently, fixed appliances (Clarity Advance Brackets with a slot size of 0.022) were placed in both arches from 7 to 7. The sequence of the arch wires in both arches was as follows: 0.014-inch nickel titanium; 0.018-inch nickel titanium; 0.017-inch x 0.025-inch titanium molybdenum alloy; 0.019-inch x 0.025-inch stainless steel; and 0.021-inch x 0.025-inch titanium molybdenum alloy.

A closing loop was made in the 0.019-inch x 0.025-inch stainless steel arch between 11 and 21, and 3/16-inch, 4.5-oz class III elastics were used (Figure 5).



Figure 4. Results of the opening created with the maxillary skeletal expander and ortho implants.



Figure 5: Intraoral picture of active orthodontic treatment with a fixed appliance (MBT).

After 3 years and 4 months of orthodontic treatment, facial congruence was achieved and the patient's profile improved (Figure 6). The posterior crossbite was corrected with the increased transverse dimension of the maxilla. Bilateral class I molar and canine relationships, an overjet of 2 mm, and an overbite of 2 mm were achieved (Figure 7). An increase in the SNA angle (81°) was achieved with the expansion of the maxilla. Additionally, there was an increase in the ANB angle (0°), which represented a better relationship between the upper and lower jaw and an improvement in the soft tissues, resulting in better lip projection (Figures 8 and 9 and Table 1).

After treatment, stability was achieved. An intraoral scan performed at 4 months after treatment showed that the bilateral class I molar and canine relationships, correct alignment between both arches, 2-mm overjet, and 2-mm overbite were maintained (Figure 10).

Discussion

A bilateral crossbite of skeletal origin is characterized by abnormalities in the growth and development of the nasomaxillary structures [1]. Maxillary disjunction or expansion is an orthopedic treatment involving the separation of the palatal suture that joins

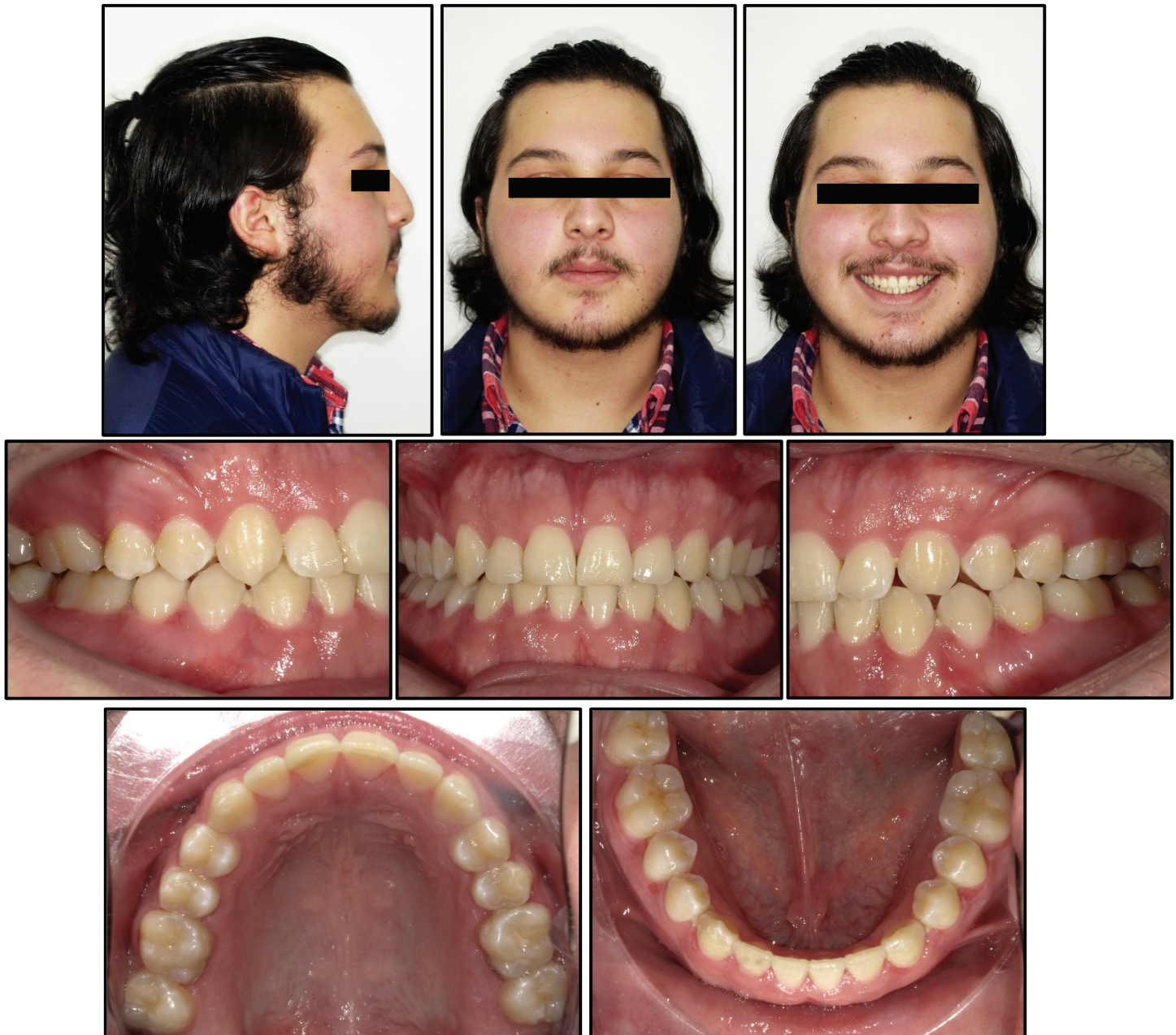


Figure 6. Photographs of the patient after extraoral and intraoral treatment.



Figure 7: Photographs of the dental models after treatment.

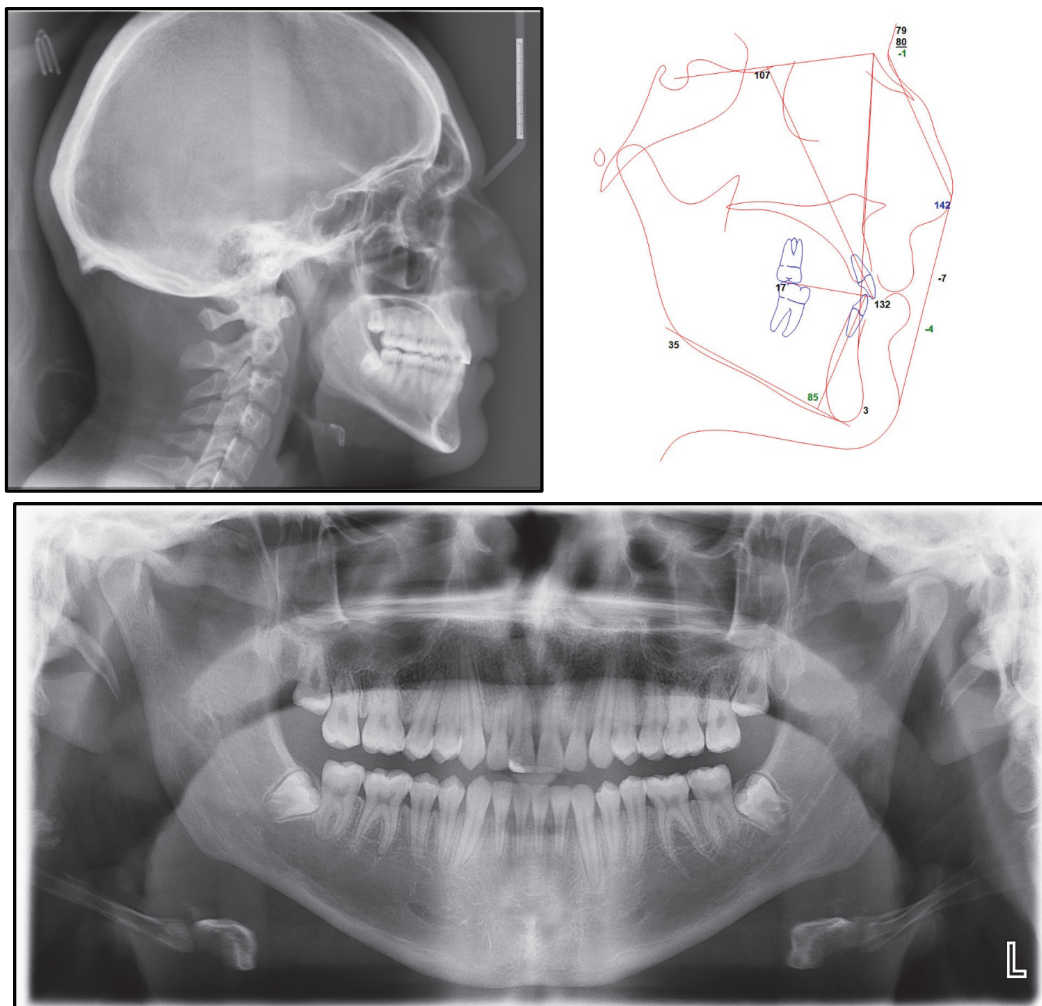


Figure 8: Cephalometric radiograph of the lateral skull after treatment (panoramic view).

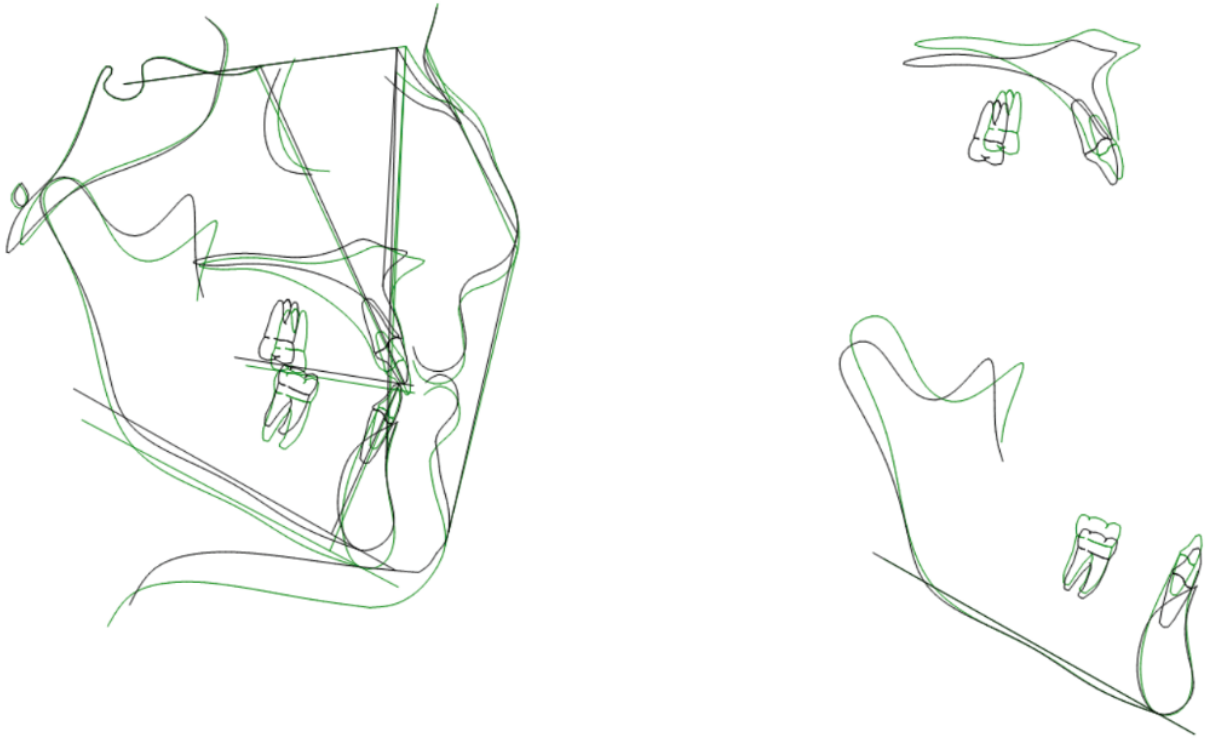


Figure 9: Initial and final cephalometric superimposition.

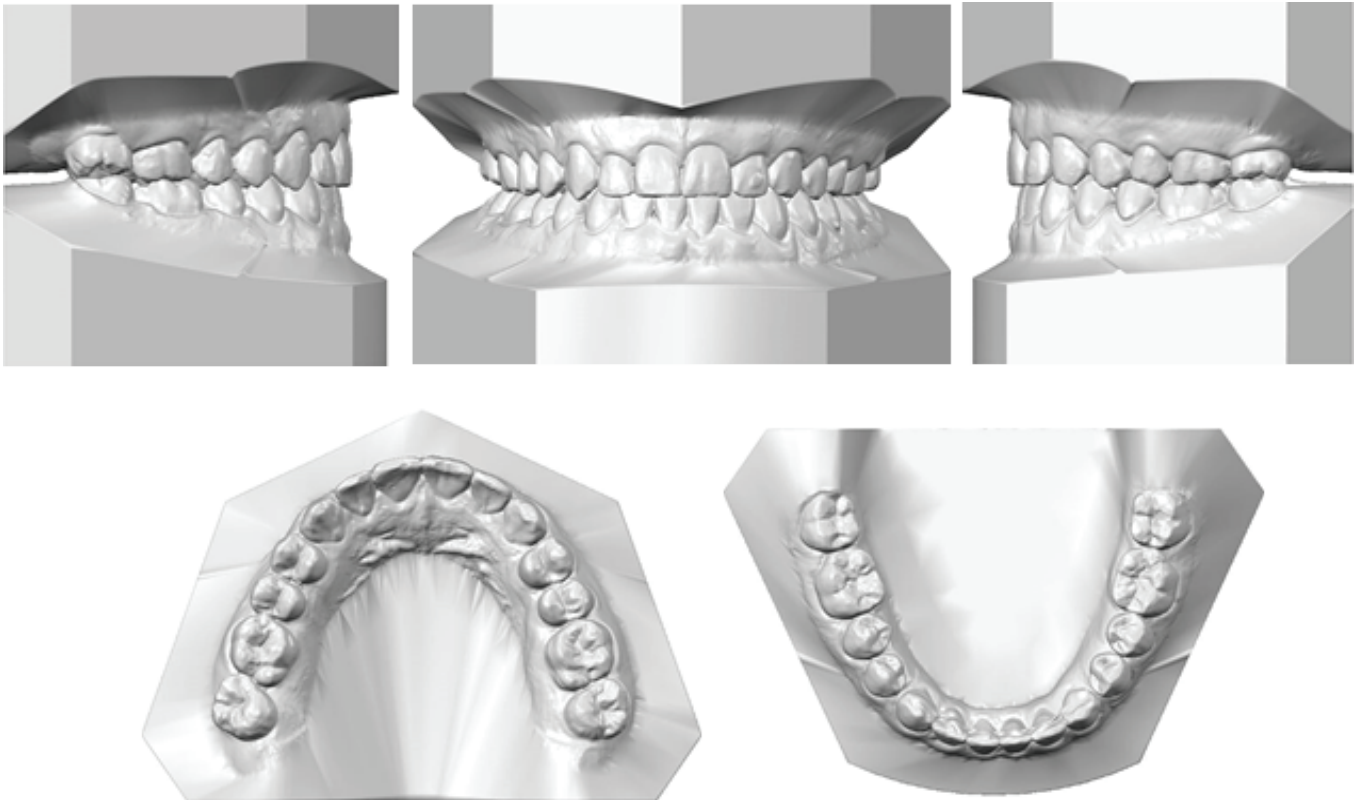


Figure 10: Photographs of the intraoral scan results 4 months after treatment.

the maxilla with other bone structures of the skeleton [3,4]. Rapid maxillary expansion is frequently used to correct maxillary compression, posterior crossbite, and arch perimeter expansion, and to alleviate dental crowding, among other changes, that occur in the circum maxillary structures [3].

Some unwanted movements caused by the orthopedic effect of disjunction with conventional rapid maxillary expansion appliances are vestibularization or inclination of the posterior teeth where the appliance is held and the risks of dehiscence, gingival recession, traumatic occlusion, and extrusion of the posterior teeth, which generate rotation of the jaw and, consequently, an open bite [5].

The optimal age for rapid palatal expansion is before 13 to 15 years of age. After 13 to 15 years of age, growth of the median suture tends to cease. For adults, the treatment of choice is SARPE [13]. However, mini screw-assisted rapid palatal expansion can be used as an alternative approach to expanding the basal bone without surgical intervention for young adults because the appliance is anchored to the teeth and bones to solve the undesirable dentoalveolar effects and optimize the potential for skeletal expansion during advanced skeletal maturation stages [13,14].

Rapid palatal expansion is a procedure that helps orthodontists solve transversal problems before the middle palatal suture has calcified. However, after calcification has occurred, rapid palatal expansion with the assistance of ortho implants can be performed because these attachments help separate the suture and avoid unwanted side effects caused by a conventional maxillary expansion appliance.

To achieve successful outcomes, it is necessary to develop a treatment plan involving the best option available. Maxillary expansion with the assistance of ortho implants has been proven to result in favorable outcomes for patients who have finished growing. Expansion treatment using the MSE and four mini screws installed in the body of the expansion screw was the best option for our patient because it allowed for true skeletal expansion through the application of force mechanics in the circum maxillary sutures.

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