

Correction of Transverse Maxillary Deficiency and Angles Class II Div 1 Subdivision Malocclusion Using Microimplant-Assisted Rapid Palatal Expansion (MARPE) and Fixed Orthodontic Therapy: A Case Report

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Abstract: *Microimplant-assisted rapid palatal expansion (MARPE) employs miniscrews to facilitate skeletal palatal expansion, thereby increasing the maxillary arch perimeter and creating additional space within the dental arch. We report a case of a 23-year 10 months-old female with an Angle Class II, division 1 subdivision malocclusion with constricted maxillary and mandibular arches. The patient's main complaint was maxillary and mandibular anterior crowding. The treatment plan included expansion of the maxillary arch using a MARPE appliance and mandibular arch with 2x6 appliance, in combination with a full-fixed appliance to align and level the crowded maxillary and mandibular teeth, along with midline and molar relation correction. A successful non-extraction orthodontic treatment was accomplished after 22 months, and the occlusion and teeth alignment, as well as facial goals, were resolved in a clinically satisfactory manner.*

Keywords: Expansion. Esthetics. Adult treatment. MARPE, 2x6 appliance

1. Introduction

A constricted maxilla has been traditionally corrected by rapid palatal expansion (RPE), but conventional RPE has been reported to be less effective in late adolescents and adults due to limitations and adverse effects, e.g. a minimal skeletal effect, undesirable tooth movement, root resorption, unfavourable periodontal consequences, and a lack of long-term stability [1–5]. The progressive complexity of the mid-palatal suture and the increased interdigitation of the craniofacial sutures are the main causes that render the maxilla more resistant to expansion [1,6,7]. Surgical-assisted rapid palatal expansion (SARPE) was developed to overcome this problem through an osteotomy and expansion appliances [1,8]. However, there are complications, including a complex treatment process, significant haemorrhage, gingival recession, root resorption, injury to the branches of the maxillary nerve, devitalization of teeth, infection, pain, periodontal breakdown, and sinus infection [1,9]. Recently, microimplant-assisted rapid palatal expansion (MARPE) has been used in late adolescents and adults, and the outcomes appear promising with an evident orthopaedic correction [1,10–12]. This case report presents the treatment of a 23-year-old female patient, with a Class II, division 1 subdivision malocclusion with constricted maxillary and mandibular arches.

2. Case Report

A female patient, aged 23 years and 10 months, sought orthodontic treatment with the main complaint related to

esthetic concerns, described as “crowded upper and lower teeth”. She was seeking a second opinion and wished to avoid tooth extraction, as well as any form of surgery. Her general state of health was good, with no contributing medical history. Pre-treatment facial photographs (Fig-1) showed a convex facial profile and potentially competent lips. The pre-treatment intraoral photographs (Fig-1) showed constricted maxillary arch and with class II molar relationship on left side and class I molar relationship on right side and Class II canine relationship on left side and Class I canine relationship on right side along with crowding of 2mm in maxillary arch and 4mm in mandibular arch. The mandibular midline was deviated 2 mm to the left. In the panoramic radiograph, all permanent teeth were visible.

Treatment Objectives

The patient had a constricted maxillary arch, with mandibular molars and premolars that were lingually inclined as a compensatory mechanism. The first objective, therefore, was to expand the maxillary arch transversely to create an adequate skeletal width, in order to correct the position of the teeth. Additional objectives were to achieve correct overbite and overjet, and to improve the dental and skeletal relationships in the three planes of space.

Treatment Alternatives

Options for treatment included the following: 1) Maxillary expansion with a Hyrax-type expander, which would require surgery (i.e., surgically-assisted rapid palatal expansion, SARPE); 2) Maxillary expansion with MARPE, in an attempt to avoid surgery; 3) Maxillary expansion with a Hyrax-type palatal expander fixed to the molars and premolars (a non-

surgical procedure); 4) Align, level, and carry out dentoalveolar expansion with the orthodontic archwires and intermaxillary elastics; and 5) Perform light interproximal reduction and extraction of four first premolars.

Treatment Progress

The second option was chosen as the treatment plan for this patient.

Treatment was initiated with the placement of a 11.0-mm maxillary skeletal expander (fabricated on a plaster cast marked with locations of four supporting miniscrews) fixed with four miniscrews (1.5 x 10 mm anterior and 1.5 x 8mm in the posterior) were inserted paramedially in the premolar region (Fig -2). After appliance placement the expansion screw was activated with two turns; the patient was instructed to reactivate the screw two full turn per day. After 3 weeks, with a 3mm diastema and 5mm of posterior expansion in the molar region, appliance was blocked (Fig-3).

Subsequently, brackets were bonded in lower arch and molar tube were bonded bilaterally and after initial alignment 2x6 appliance was inserted (Fig-4)[21]. After this all teeth were bonded. The following archwires were used: 0.016 x 0.016-in NiTi heat-activated, 0.016 x 0.022-in NiTi, 0.017 x 0.025-in NiTi heat-activated, 0.018 x 0.025-in SS, and 0.019 x 0.025-in SS finishing archwire.

Differential force class II elastics were given to correct molar relation (Fig -5).

3. Results

After 22 months of treatment, the esthetic and functional dental and facial goals of the treatment were achieved. The Class II malocclusion was corrected, and the overjet and overbite were satisfactorily reduced. For the retention phase, a wraparound type retainer in the maxillary arch was used and worn full-time for one year, after which it would be required for nighttime use only during subsequent years, to maintain occlusal stability (Fig-6).

4. Discussion

This case report is not unusual, but represents a clinical situation routinely found in daily practice, and an example of a case in which a posterior crossbite was not an essential clinical condition for undertaking maxillary expansion. The treatment improved the transverse maxillary dental arch dimension with a MARPE appliance during the first stage, followed by mandibular arch expansion during treatment with 2x6 appliance.

Rapid maxillary expansion (RME) is typically the standard treatment method for patients presenting transverse deficiency of the maxillary bone. RME can be successfully carried out in young patients who do not have a closed midpalatal suture,[13] and the treatment can be accomplished with tooth anchorage.

The adult patient in the present case report did not wish to undergo surgery, that is, she did not want to undergo SARPE. And the RME attempt was not considered due to the

uncertainty of the successful outcome. Since MARPE was first described, it has been shown that the maxilla could be expanded with skeletal disjunction and without SARPE.[14] Therefore, the MARPE approach was chosen and executed, and the post-treatment records demonstrate that a successful result was achieved.

The advantages and limitations of non-surgical RPE in adult patients should be individually analyzed to determine the risks and benefits,[15] as described for the patient reported here. The selected expander needed to be larger than necessary for the expansion.

The expander selected needs to deliver the maximum expansion capacity and should be kept at an ideal vertical distance from the palatal mucosa, as was achieved in the present case report.

Ricketts et al. [16] concluded that 1 mm of canine expansion produces 1 mm of arch length increase, and 1 mm of molar expansion results in an increase of 0.25 mm in arch length.

Thus, to achieve a good outcome for the non-extraction treatment used in the present case, with a crowded and constricted dental arch, it was necessary to increase the arch perimeter to allow for arch alignment and leveling.

The present case report showed that maxillary and mandibular arch expansion, followed by a fixed orthodontic appliance, led to increases from 23 mm to 28 mm in intercanine width, and 41 mm to 49 mm in intermolar width for the lower arch. In the upper arch, intercanine distance increased from 32 mm to 35 mm, and intermolar distance from 47 mm to 56 mm. The arch perimeter increased 5.3 mm and 6.0 mm for mandibular and maxillary arches, respectively. Adkins et al.[17] found an increase of 4.7 mm in the upper arch perimeter after RPE with a Hyrax appliance in an adolescent patient, and McNamara et al.[18] found an increase from 3 to 4 mm for maxillary arch expansion in children; whereas, Handelman et al.[19] found those measurements to be 4.5 to 5.5 mm in adults. In the mandibular arch, the example provided by McNamara et al.[18] increased by only 1 to 2 mm. However, there was a difference in measurement methods: we measured from the tip of the canines, whereas McNamara et al. [18] used lingual landmarks. In our case, this gain was enough to increase the arch perimeter, correct the enlarged overjet, and solve the problem of mandibular crowding.

We observed a clinically favorable occlusion and esthetic gain in our patient 1 year after treatment. Permanent mandibular retention was chosen due to the strong tendency toward arch-width relapse, as described in the literature.[20] In addition, mandibular crowding was the patient's main complaint before treatment.

Overall, simultaneous maxillary and mandibular arch expansion using a nonsurgical approach is a viable procedure for young adults. In selected cases, it can offer a clinically favorable result in the long term. No periodontal disease occurred in this patient, since she presented good oral hygiene.

5. Conclusion

An adult patient with mildly constricted maxillary and mandibular arches was successfully treated with the MARPE

appliance as an adjunct to a fixed appliance. The final outcome was functional occlusion and satisfactory facial esthetics that met the patient's expectations. The 1-year follow-up showed the stability of the results.

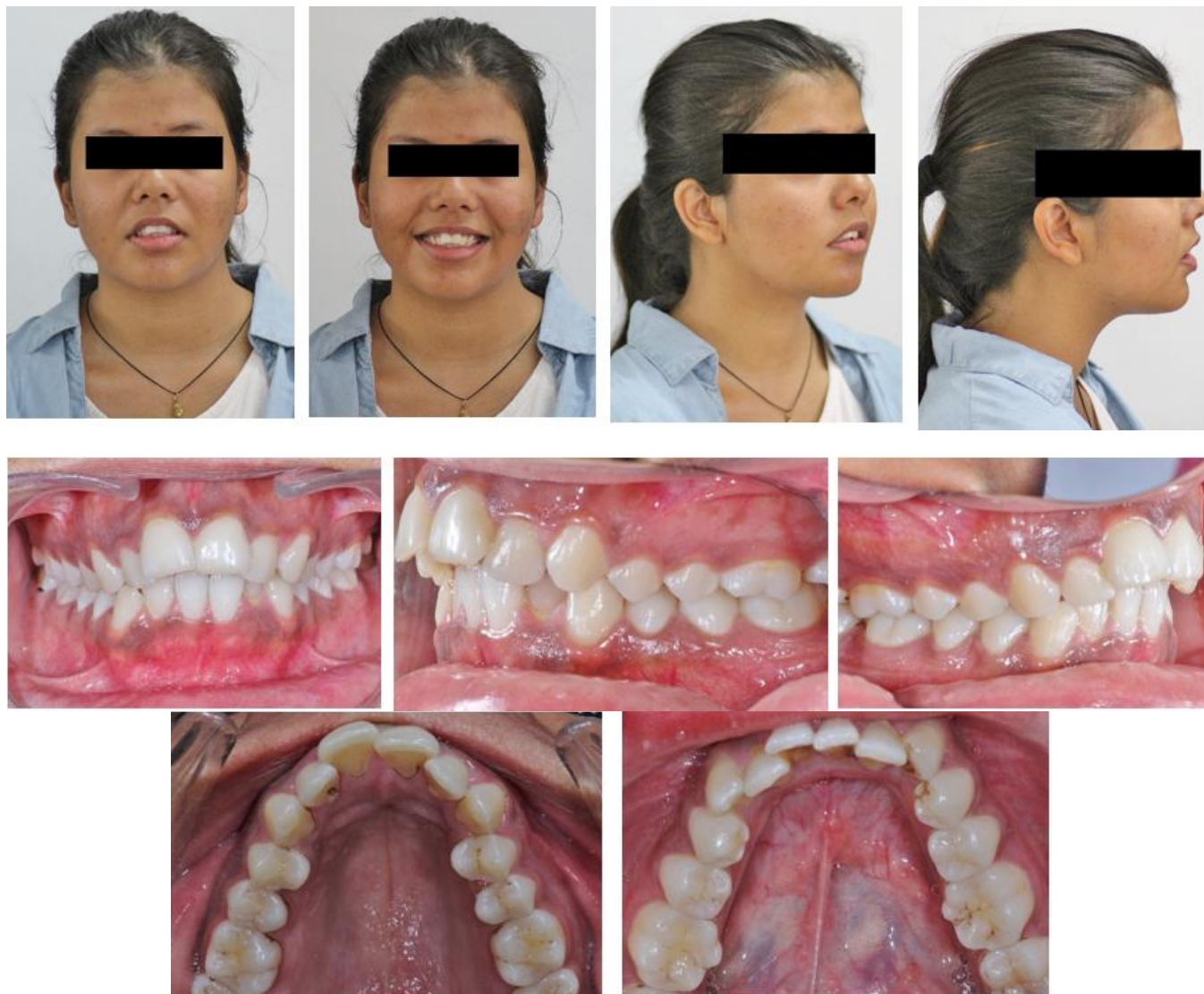


Figure 1



Figure 2



Figure 3



Figure 4



Figure 5





Figure 6

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