Correction of Skeletal Transverse Discrepancy and Open Bite after Relapse using MARPE - A Case Report

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Article Info.
Submitted: Jul 1, 2025
Accepted: Mar 22, 2026

How to Cite?
Kumar D, Jain CK, Yadav S, Sharma R. Correction of skeletal transverse discrepancy and open bite after relapse using marpe - a case report. Orthod J Nepal. 2025;15(2):16-20.

DOI: https://doi.org/10.3126/ojn.v15i2.80840

Full text available at
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ABSTRACT

Miniscrew-Assisted Rapid Palatal Expansion (MARPE) is an effective technique designed to treat maxillary transverse deficiencies, particularly in patients who are beyond their peak growth period.. This case report discusses a 15-year-old male who presented with irregularly aligned upper and lower anterior teeth. He had previously undergone orthodontic treatment involving the extraction of all first premolars. The treatment plan involved maxillary expansion using a custom-fabricated MARPE appliance and supported by two temporary anchorage devices (TADs), in combination with full-fixed orthodontic appliances for alignment and levelling. The treatment, completed over 18 months without further extractions, resulted in well-aligned arches, correction of the crossbite, improvement of the open bite, and enhanced facial aesthetics. This case demonstrates the successful application of MARPE as a non-surgical approach to managing complex malocclusions involving transverse and vertical discrepancies in late adolescent patients.

Keywords: Adolescent orthodontics, Cone Beam Computed Tomography (CBCT), MARPE, Skeletal expansion, Transverse deficiency.

INTRODUCTION

Transverse skeletal discrepancy may present as unilateral or bilateral posterior crossbite, dental crowding, and a constricted nasal cavity, all of which can influence both oral function and facial aesthetics. Rapid maxillary expansion addresses this deficiency by delivering transverse forces that exceed those necessary for mere dental movement. These forces generate tensile stress across the circummaxillary sutures, particularly the midpalatal suture, facilitating their mechanical separation. Following this expansion, bone deposition and remodeling occur within the suture region, contributing to the stabilization of the skeletal changes achieved.[1]

Maxillary transverse deficiency has been reported to affect approximately 12–14% of individuals with permanent dentition.[2] Rapid maxillary expansion (RME) is widely recognized as a reliable and successful method for managing maxillary transverse deficiencies in pediatric patients, particularly when applied prior to the closure of the midpalatal suture. During childhood, the skeletal response to RME is typically favorable due to the flexibility and incomplete ossification of the suture. However, as individuals approach or surpass the

ISSN: 2091-1327 (Print), 2091-1335 (Online)

pubertal growth spurt, progressive suture maturation and ossification significantly reduce the predictability and effectiveness of this intervention. In such cases, conventional RME may result in undesirable dental effects, including buccal tipping of the anchor teeth, root resorption, and alveolar complications such as dehiscence's and fenestrations. Consequently, in adolescents and adults, surgically assisted maxillary expansion is often indicated to promote true skeletal separation while minimizing adverse dental and periodontal outcomes.[3,4]

Following puberty, the midpalatal suture undergoes increased interdigitation, which has traditionally led some researchers to conclude that maxillary expansion in post-pubertal individuals is not viable without surgical intervention. As a result, surgically assisted rapid palatal expansion (SARPE) has often been recommended for these cases.[3,4] However, more recent studies[5,6] suggest that successful separation of the midpalatal suture may still be achievable in late adolescents through the use of both bone-borne and tooth-borne palatal expanders. The introduction of miniscrew-assisted rapid palatal expansion (MARPE) devices was intended to improve the orthopedic outcomes of maxillary expansion, particularly by minimizing unwanted dental side effects. While some investigations have demonstrated a greater skeletal response with bone-borne expanders, other findings indicate that both bone-borne and tooth-borne appliances can produce comparable skeletal effects, highlighting ongoing variability in clinical outcomes.[7,8,9]

CASE REPORT:

This is a case of a 15-year- old male reported to orthodontic department with posterior skeletal cross bite and open bite with no relevant medical history. The patient had a dental history of orthodontic treatment from a private clinic, with all first premolars extractions. Pre-treatment extraoral photographs (Fig. 1) showed convex facial profile and leptoprosopic facial form. In front view, a small asymmetry was visible in which mandible is shifted to left side.

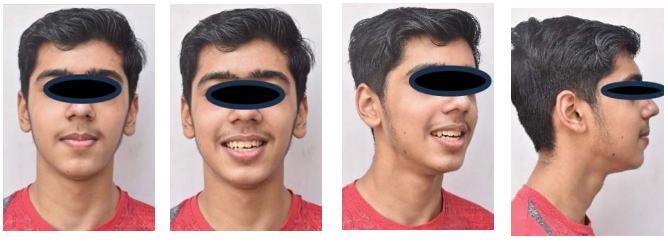

Fig.1 Extraoral photographs

The pre-treatment intraoral photographs (Fig. 2) showed a constricted maxillary arch with unilateral crossbite in the posterior segment on the left side. He presented an Angle's Class II malocclusion, subdivision, mild crowding in upper and lower anteriors, an overjet of 0mm, anterior open bite of 1mm. The mandibular midline was deviated 3mm to the left.

Fig.2 Intraoral photographs

In the panoramic radiograph, all permanent teeth were visible except the first premolars (Fig. 3).

Fig.3 Panoramic radiograph

The analysis of the pretreatment lateral cephalometric radiograph and tracings (Fig. 4) revealed a Class II skeletal pattern ANB = 5º with orthognathic maxilla (SNA = 81º), protruded mandibular incisors (L1-NB = 29º/9mm and incisal mandibular plane angle (IMPA= 99º), and protruded maxillary incisors (U1-NA = 7mm).

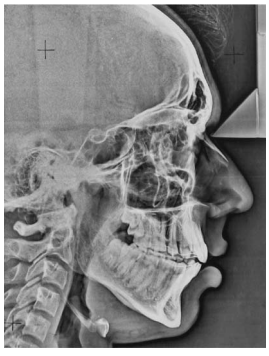

Fig.4 Lateral cephalogram

Table 1: Pretreatment and post-treatment measurements.

Measurements	Parameters	Normal	Pre-treatment	Post-treatment
Skeletal	SNA	82°	81°	81°
	SNB	80°	76°	76°
	ANB	2°	5°	5°
	Wits	0-1mm	1mm	1mm
	Convex. angle	0°	8°	8°
	SN-GoGn	32°	37°	37°
	FMA	25°	30°	30°
Dental pattern	IMPA	90°	99°	99°
	U1- NA	22°	25°	24°
	U1-NA	4mm	4mm	4mm
	L1-NB	25°	29°	26°
	L1-NB	4mm	9mm	9mm
	U1-L1	130°	127°	127°
Soft tissue profile	U1-S	0mm	0mm	0mm
	L1-S	0mm	3mm	3mm

Treatment objectives: The primary problem with this patient had constricted maxillary arch and open bite. 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 as this was the case of relapse. 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: Several treatment options were considered for this case. The first involved surgically assisted rapid palatal expansion (SARPE) using a Hyrax-type appliance, which would require surgical intervention. Alternatively, maxillary expansion with a Miniscrew-Assisted Rapid Palatal Expander (MARPE) was proposed in an effort to avoid surgery. A third option was conventional maxillary expansion using a Hyrax appliance fixed to the molars and premolars, which is a non-surgical approach but relies mainly on dental anchorage. Lastly, dentoalveolar expansion could be achieved through orthodontic alignment, leveling, and the use of archwires combined with intermaxillary elastics to correct the transverse discrepancy.

Treatment progress: The second treatment option was selected for this patient. The procedure began with the placement of a 1.5 cm X 2 mm maxillary skeletal expander secured by two miniscrews anteriorly and anchored on molars, premolars through metal printed design. Appliance is designed using 3D intraoral digital scans CBCT and STL files, to match patient unique palatal anatomy, minimising the impingement on soft tissue and roots. STL files for MARPE was sent to a 3D metal printing service that use selective laser melting metal printed enables infinitely customizable CAD/CAM design to be produces for clinical use (Fig. 5).

Two initial activations were performed immediately (equivalent to half a turn), followed by two turns per day for one week. On the fourth day, the patient reported pain and discomfort in the palate and nasal regions, along with headaches. These symptoms were managed by reducing the activation rate to one turn per day and prescribing analgesics. The patient noted the development of a midline diastema during expansion. A slight opening of the anterior bite was also observed, caused by the buccal cusp of the left first maxillary molar contacting the overlapping mandibular molar. After a total of 25 turns, expansion was discontinued, and the appliance was stabilized. Radiographic palatal imaging confirmed successful midpalatal suture opening (Fig. 5).

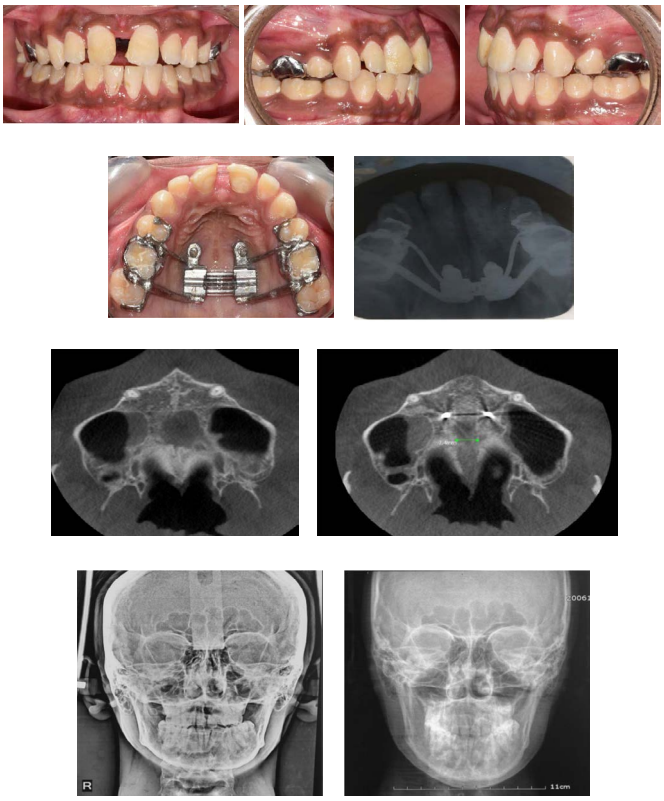

Fig.5 Intraoral photos, palatal view, CBCT and radiograph images(P-A) before and after maxillary expansion

Following expansion, orthodontic brackets were bonded to all teeth except the first molars as banding was done on upper 1st molars. Initially levelling was used by round ni-ti wires. The sequence of archwires used included 0.016-inch NiTi, 0.016 × 0.022-inch NiTi, 0.017 × 0.025-inch NiTi, and finally, a 0.019 × 0.025-inch stainless steel finishing archwire.

RESULTS

After 18 months of treatment, the desired skeletal expansion was achieved . Functional outcomes for both the dental structures and facial profile were successfully attained (Fig. 6).

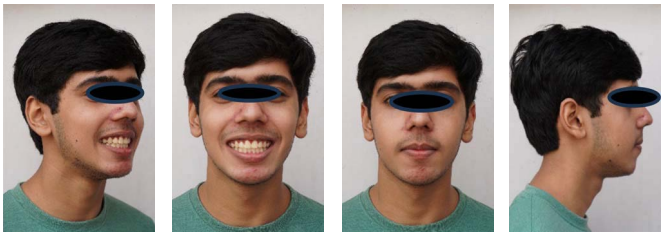

Fig.6 Extraoral photographs

The patient exhibited a convex facial profile with passive lip closure. The initial Class II malocclusion was effectively corrected, with satisfactory overjet and overbite relationships established (Fig.7 ,8).

Fig.7 Intraoral photographs –post treatment

Fig. 8 OPG and Lateral Cephalogram -Post treatment

During the retention phase, a maxillary and mandibular essix retainer (Fig. 9) was prescribed be worn full-time for one year, followed by night time use in the following years to preserve occlusal stability.

Fig. 9 Upper and lower Essix retainer

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 rectangular archwires, in accordance with McNamara et al.[4]

Rapid maxillary expansion (RME) is commonly used as the primary approach for addressing transverse deficiencies of the maxilla. In growing patients whose midpalatal suture has not yet fused, RME can be effectively performed using appliances anchored to the teeth. This allows for skeletal expansion with favorable outcomes when initiated during the early stages of craniofacial development.[5]

In this case report, the adult patient declined surgical

intervention and did not consent to undergo surgically assisted rapid palatal expansion (SARPE). Given the unpredictability of outcomes associated with conventional rapid maxillary expansion (RME) in adults, this option was also ruled out. With the advent of (MARPE), evidence[6] has shown that skeletal expansion of the maxilla can be achieved without surgery. As a result, the MARPE technique was selected and successfully implemented in this case. Post-treatment records confirmed a favourable outcome (Fig-7,8). Nonetheless, the decision to pursue non-surgical Rapid palatal expansion in adult patients should be carefully evaluated on a case-by-case basis, weighing the potential benefits against the limitations, as demonstrated in this clinical scenario.[6]

A study conducted by Walter et al.,[7] shows that MARPE causes 4.08 mm expansion in the midplatal region and Sish et al,[8] study shows 5.2 mm expansion in cone beam computer tomography.

A systematic review by siddhisaributr et al.,[9] also shows the midplatal expansion of 4.56 mm on CBCT scan. In our patient mid palatal exapansion of 7.4 mm is achieved. This shows that MARPE could successfully expand the constricted maxilla in late adolescent and adult patient.

CONCLUSION

An adult patient presenting with mild constriction of both the maxillary and mandibular arches was effectively treated using a MARPE appliance alongside fixed orthodontic appliances. The treatment resulted in a functional bite and facial aesthetics that aligned with the patient's goals. Follow-up after one year demonstrated that these results remained stable over time.

ETHICAL CONSIDERATIONS

Written informed consent was obtained from the patient for treatment and publication of clinical data and photographs.

CONFLICT OF INTEREST: None

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