IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 25, Issue 10 Ser. 4 (October. 2026), PP 30-33
www.iosrjournals.org

Rapid Maxillary Expansion for Bilateral Posterior Crossbite with Severe Crowding Management: A Case Report

Vesna Trpevska[1], Martina Pop Angelova Nojkova[2], Sara Baara Dodevska[3], Blerim Sallai[4], Marija Jordanova[5], Cena Dimova[6]

[1]*Faculty of Medical Science, Goce Delcev University, Stip, PHO Dental Clinical Centre – Skopje, N. Macedonia*
[2]*PHO MADENTA, Kavadarci, N. Macedonia*
[3]*PHO SocialDentDr.Baara, Skopje, N. Macedonia*
[4]*PHO BLE DENT, S. Negotino Opstina Vrapciste, N. Macedonia*
[5]*PHO Dr Jordanov, Stip, N. Macedonia*
[6]*Faculty of Medical Science, Goce Delcev University, Stip, N. Macedonia*

Abstract:
Background*: Transverse maxillary deficiency with bilateral posterior crossbite frequently coexists with a substantial tooth-size–arch-length discrepancy. Rapid maxillary expansion (RME) reliably corrects the transverse problem, but the arch perimeter it adds may be insufficient to resolve severe crowding. Treatment planning therefore has to separate the two problems.*
Materials and Methods*: An 11.5-year-old girl presented with bilateral posterior crossbite, transverse maxillary deficiency and pronounced anterior crowding. A tooth-borne Hyrax expander was used and then left in place as a passive retainer. Clinically significant crowding persisted after transverse correction, and the maxillary first premolars were extracted before maxillary fixed appliance therapy. Persistent mandibular space deficiency led to extraction of the mandibular first premolars and placement of a mandibular fixed appliance.*
Results*: RME corrected the bilateral posterior crossbite and the correction was maintained clinically during retention. Expansion alone did not provide enough space for alignment. Staged extraction combined with fixed appliance therapy produced progressive relief of crowding and teeth alignment.*
Conclusion: *In growing patients with bilateral posterior crossbite and severe crowding, transverse correction and space creation should be planned as separate objectives. Residual space requirements should be reassessed after expansion and retention, before an extraction decision is made for each arch.*
Key Word*: Transverse maxillary deficiency, Posterior crossbite, Rapid maxillary expansion (RME), tooth crowding.*

Date of Submission: 12-10-2026 Date of Acceptance: 24-10-2026

I. Introduction

Posterior crossbite is a transverse malocclusion in which the maxillary posterior teeth occlude lingually to their mandibular antagonists. It may be unilateral or bilateral and is commonly associated with transverse maxillary deficiency. Spontaneous correction is unpredictable, and untreated crossbite may persist into the permanent dentition. Associations with functional asymmetry and altered occlusal development have been reported across studies.[1, 2] Rapid maxillary expansion (RME) is an established treatment for transverse maxillary deficiency in growing patients. Its effect combines skeletal and dentoalveolar components, whose relative contributions depend on skeletal maturation, age, appliance design, and individual response.[3, 4] Tooth-borne Hyrax expanders produce clinically relevant transverse changes in adolescents.[5, 6] Moreover, they are appropriate for patients who need to gain arch width for correcting moderate maxillary crowding or need to expand the maxilla more than 4 mms.[7, 8] Additionally, nasal airway resistance may be improved by use of RME, although there may be little long term benefit. [9, 10] RME can produce heavy force that creates orthopedic expansion not only of the intermaxillary suture but is also distributed to adjacent craniofacial bones such as sphenoid and zygomatic bones with a screw turn-rate 0.2 to 0.4 mm per day. This force generates maximum orthopedic expansion with minimal orthodontic tooth movement.[11] Transverse deficiency often coexists with severe crowding. Expansion increases arch width and, to a lesser degree, arch perimeter, but this gain does not necessarily eliminate a large tooth-size–arch-length discrepancy. When adequate alignment cannot be achieved without excessive dental expansion or incisor proclination, premolar extraction remains an established option. The decision should rest on the full skeletal, dental, facial and space assessment rather than on crowding severity alone.[12, 13] Published cases show that the space-management step after expansion varies. Wangsrimongkol et al. combined Hyrax expansion with four-premolar extraction for complete maxillary

crossbite with severe crowding, [14] whereas Chen et al. managed severe maxillary space deficiency with posterior crossbite without extraction. [15] Retention after expansion is a further variable: protocols are heterogeneous and long-term transverse stability depends on several patient- and treatment-related factors. [16, 17] This report describes a growing patient with bilateral posterior crossbite and severe crowding treated with Hyrax RME, followed by extraction decisions made separately for each arch after reassessment of residual space.

II. Material And Methods

An 11.5-year-old girl was referred to the orthodontic clinic because of an abnormal occlusal relationship and irregular anterior teeth. She was healthy and had no relevant medical history. Clinical examination showed bilateral posterior crossbite associated with transverse maxillary deficiency and pronounced anterior crowding with insufficient space for alignment of the anterior teeth (Fig. 1). Records comprised clinical examination, intraoral photographs and a panoramic radiograph. The findings were interpreted as two related but partly independent problems: a transverse maxillary deficiency requiring orthopedic correction, and a dental space deficiency whose residual extent could only be judged after that correction.



Figure 1. Initial intraoral photographs before treatment.

Treatment objectives

[1]. Correct the transverse maxillary deficiency and eliminate the bilateral posterior crossbite.
[2]. Maintain the transverse correction during a retention phase.
[3]. Reassess residual space deficiency in each arch after transverse correction.
[4]. Create space where required and align and level both dental arches.
[5]. Coordinate the arches and close the extraction spaces.

Treatment plan

Given the patient's age and expected remaining growth, transverse correction was prioritized before definitive alignment. A tooth-borne RME was placed. The patient activated the jackscrew at the rate of 0.2 mm, one turn per day for six weeks until the occlusal aspect of maxillary lingual cusps of first molars contacted the occlusal aspect buccal cusps of mandibular first molars, followed by 5 months of maintenance phase (Fig. 2). After transverse correction, clinically significant crowding and insufficient arch space remained. The maxillary first premolars (tooth 14 and tooth 24) were extracted, and a maxillary fixed appliance was placed for alignment, leveling and space management. After that, persistent mandibular crowding and space deficiency led to extraction of the mandibular first premolars (tooth 34 and tooth 44) and placement of a mandibular fixed appliance. Alignment of teeth in both archers is still in progress (Fig. 3).

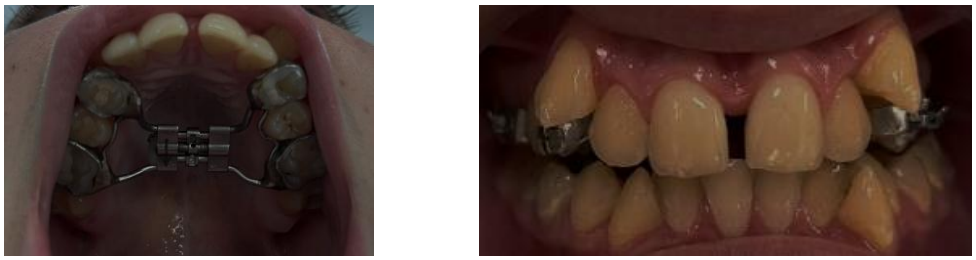


Figure 2. Intraoral views showing the Hyrax appliance after 10 weeks of rapid maxillary expansion.



Figure 3. Intraoral views showing fixed appliance in both arches after the 4 premolars extraction.

III. Results and Discussion

Hyrax RME corrected the bilateral posterior crossbite and improved the transverse interarch relationship. The correction was maintained clinically during passive retention with the appliance. Clinically significant anterior crowding persisted after transverse correction. Maxillary first-premolar extraction provided space for maxillary alignment, and subsequent mandibular first-premolar extraction addressed the remaining mandibular space deficiency. Fixed appliance therapy produced progressive alignment and reduction of anterior crowding in both arches. Several methods of arch expansion are possible, but to obtain skeletal effects, it is necessary to place force directly across the suture. As age advances, the midpalatal suture becomes increasingly interdigitated, thereby increasing resistance to orthopedic expansion. However, substantial transverse skeletal expansion remains achievable in most individuals up to the age of 15 years. In adolescents, semi-rapid maxillary expansion using a Hyrax appliance activated at a rate of 0.25 mm per day is often preferred, as it produces a more physiological sutural response, allowing adequate time for tissue remodeling and new bone deposition while minimizing adverse effects on the supporting structures. The following case report illustrates the use of maxillary expansion for correction of transverse deficiency, followed by extractions. [18] This case shows that correcting a transverse maxillary deficiency and resolving severe crowding are separate treatment objectives, although one appliance initiates both. While RME does increase arch perimeter—typically gaining about 0.7 mm of arch space for every 1 mm of inter-molar width increase—this expansion is rarely enough to resolve a major tooth-size–arch-length discrepancy. Hyrax RME eliminated the bilateral posterior crossbite, yet the space it provided was insufficient for alignment, and extraction was ultimately required in both arches. The transverse result is consistent with randomized and systematic evidence that Hyrax-type expanders produce combined skeletal and dental changes in adolescents, with magnitudes that depend on maturation and individual response.[3-6] The persistence of crowding after expansion has a simple geometric basis. Arch perimeter increases considerably less than intermolar width during expansion, [19] so a large tooth-size–arch-length discrepancy can remain after a fully corrected crossbite. Comparable cases have been resolved both with four-premolar extraction and without extraction, which indicates that expansion itself does not determine the space-management strategy.[14, 15] Gohl's study showed RME appliances increase the inter-canine and inter-molar width at CEJ levels around 2.79 and 3.27 mm, respectively, using three-dimensional computed tomography. Our patient showed at the gingival level, an inter-canine width increase of 6 mm whereas inter molar width increased 5.5 mm. [20] Systematic reviews report differences in arch dimensions and soft-tissue effects between extraction and non-extraction treatment, with limited certainty for several outcomes, [13, 14] a similar combination of expansion and extractions has recently been reported for a Class I patient with bilateral crossbite and a vertical growth pattern. [21]

IV. Conclusions

In this growing patient, Hyrax RME corrected the bilateral posterior crossbite but did not provide enough space to resolve severe crowding. Reassessment after expansion and retention led to staged first-premolar extraction in each arch, followed by comprehensive fixed appliance therapy with progressive alignment. Transverse correction should not be equated with space creation, and extraction decisions can be made per arch after the response to expansion is known. Definitive conclusions on finishing, space closure and stability require post-treatment follow-up.

References

[1]. Andrade AS, Gameiro GH, Derossi M, Gavião MBD. Posterior crossbite and functional changes: a systematic review. Angle Orthod. 2009; 79(2):380-386. doi:10.2319/030708-137.1 https://sci-hub.box/10.2319/030708-137.1

[2]. Ugolini A, Agostino P, Silvestrini-Biavati A, Harrison JE, Batista KBSL. Orthodontic treatment for posterior crossbites. Cochrane Database Syst Rev. 2021; 12(12):CD000979. doi: 10.1002/14651858.CD000979.pub3 https://www.researchgate.net/publication/357368939_Orthodontic_treatment_for_posterior_crossbites

[3]. Baccetti T, Franchi L, Cameron CG, McNamara JA Jr. Treatment timing for rapid maxillary expansion. Angle Orthod. 2001; 71(5):343-350. doi:10.1043/0003-3219(2001)071<0343: TTFRME>2.0.CO;2 https://media.dent.umich.edu/labs/mcnamara/files/Treatment%20Timing%20for%20Rapid%20Maxillary%20Expansion.pdf

[4]. Seif-Eldin NF, Elkordy SA, Fayed MS, Elbeialy RA, Eid FH. Transverse skeletal effects of rapid maxillary expansion in pre and post pubertal subjects: a systematic review. Open Access Maced J Med Sci. 2019; 7(3):467-477. doi:10.3889/oamjms.2019.080 https://www.researchgate.net/publication/330995404_Transverse_Skeletal_Effects_of_Rapid_Maxillary_Expansion_in_Pre_and_Post_Pubertal_Subjects_A_Systematic_Review_A_Systematic_Review

[5]. Weissheimer A, de Menezes LM, Mezomo M, Dias DM, de Lima EMS, Rizzatto SMD. Immediate effects of rapid maxillary expansion with Haas-type and Hyrax-type expanders: a randomized clinical trial. Am J Orthod Dentofacial Orthop. 2011; 140(3):366-376. doi: 10.1016/j.ajodo.2010.07.025 https://www.researchgate.net/publication/51616378_Immediate_effects_of_rapid_maxillary_expansion_with_Haas-type_and_hyrax-type_expanders_A_randomized_clinical_trial

[6]. Wang Y, Yang Y, Li Q, et al. Three-dimensional skeletal and dental effects of the Haas vs. Hyrax type expanders in adolescent rapid maxillary expansion: systematic review and meta-analysis. J Orofac Orthop. 2026. doi:10.1007/s00056-026-00670-w https://www.researchgate.net/publication/408732667_Three-dimensional_skeletal_and_dental_effects_of_the_Haas_vs_hyrax_type_expanders_in_adolescent_rapid_maxillary_expansion_Systematic_review_and_meta-analysis

[7]. Proffit WR, Fields HW, Sarver DM. Contemporary orthodontics. 4th ed. St. Louis: Mosby Elsevier; 2007.

[8]. Bishara SE, Staley RN. Maxillary expansion: clinical implications. Am J Orthod Dentofacial Orthop 1987; 91: 3-14.

[9]. Haas AJ. Rapid expansion of the maxillary dental arch and nasal cavity by opening the midpalatal suture. Angle Orthod 1961; 31: 73-90.

[10]. Haas AJ. Palatal expansion: just the beginning of dentofacial orthopedics. Am J Orthod 1970; 57: 219-55.

[11]. Haas AJ. The treatment of maxillary deficiency by opening the midpalatal suture. Angle Orthod 1965; 35: 200-17.

[12]. Lopes Filho H, Maia LH, Lau TCL, de Souza MMG, Maia LC. Early vs late orthodontic treatment of tooth crowding by first premolar extraction: a systematic review. Angle Orthod. 2015; 85(3):510-517. doi:10.2319/050814-332.1 https://www.researchgate.net/publication/265516526_Early_vs_late_orthodontic_treatment_of_tooth_crowding_by_first_premolar_extraction_A_systematic_review

[13]. Elias KG, Sivamurthy G, Bearn DR. Extraction vs nonextraction orthodontic treatment: a systematic review and meta-analysis. Angle Orthod. 2024; 94(1):83-106. doi:10.2319/021123-98.1 https://www.researchgate.net/publication/375085000_Extraction_vs_nonextraction_orthodontic_treatment_a_systematic_review_and_meta-analysis/link/68de427e220a341aa1523205/download?_tp=eyJjb250ZXh0Ijp7ImZpcnN0UGFnZSI6InB1YmxpY2F0aW9uIiwicGFnZSI6InB1YmxpY2F0aW9uIn19 (pdf)

[14]. Wangsrimongkol T, Manosudprasit M, Pisek P, Leelasinjaroen P. Correction of complete maxillary crossbite with severe crowding using Hyrax expansion and fixed appliance. J Med Assoc Thai. 2013; 96(Suppl 4):S149-S156. http://www.jmatonline.com/PDF/S149-S156-PB-96-S4.pdf

[15]. Chen MY, Tai WK, Chang HMM, Luk HS, Kao CT. Rapid maxillary alveolar expansion in maxillary severe space deficiency. Taiwanese J Orthod. 2018; 30(4): Article 2. doi:10.30036/TJO.201812_30(4).0002 https://www.tjo.org.tw/cgi/viewcontent.cgi?article=1040&context=tjo

[16]. Costa JG, Galindo TM, Mattos CT, Cury-Saramago AA. Retention period after treatment of posterior crossbite with maxillary expansion: a systematic review. Dental Press J Orthod. 2017; 22(2):35-44. doi: 10.1590/2177-6709.22.2.035-044.oar https://www.scielo.br/j/dpjo/a/DNwzzJ5rGRsbzFMHHNWyqKD/?lang=en

[17]. Beltrami F, Kiliaridis S, Antonarakis GS. Long-term stability of posterior crossbite correction, treated in the mixed or permanent dentition of growing children: a systematic review and meta-analysis. Orthod Craniofac Res. 2024; 27(1):1-14. doi:10.1111/ocr.12690 https://onlinelibrary.wiley.com/doi/10.1111/ocr.12690

[18]. Joy J, Anilkumar. Methods of maxillary arch expansion in orthodontics: A literature review. Int J Appl Dent Sci. 2021; 7(2):251-4.

[19]. Adkins MD, Nanda RS, Currier GF. Arch perimeter changes on rapid palatal expansion. Am J Orthod Dentofacial Orthop. 1990; 97(3):194-199. https://www.academia.edu/105718056/Arch_perimeter_changes_on_rapid_palatal_expansion

[20]. Gohl E, Nguyen M, Enciso R. Three-dimensional computed tomography comparison of the maxillary palatal vault between patients with rapid palatal expansion and orthodontically treated controls. Am J Orthod Dentofacial Orthop 2010; 138: 477 85.

[21]. Vijayan R. Indian Board of Orthodontics case report: orthodontic management of a Class I malocclusion with bilateral posterior crossbite and vertical growth pattern using maxillary expansion followed by achieving vertical control using skeletal anchorage and extractions. J Indian Orthod Soc. 2026. doi:10.1177/03015742261473725 https://journals.sagepub.com/doi/full/10.1177/03015742261473725