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Case Series

Expansion appliances to correct malocclusion: A Case Series

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ABSTRACT

This case series examines the use of both type of expansion appliances (Slow and Rapid) in treating various malocclusions. It includes patients with Class I malocclusion accompanied by bimaxillary protrusion, as well as Class III malocclusion with a history of cleft lip and palate. The series features both removable and fixed appliances used to correct malocclusions, with and without functional shifts. This case series aims to offer practitioners, particularly paediatric dentists valuable insights into managing similar cases using these techniques.

***Keywords:** Expansion appliance, Malocclusion, RME*

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INTRODUCTION

The theory behind Slow Maxillary Expansion (SME) suggests that the primary resistance to opening the suture of palate (middle) doesn't particularly start from it but from tissues around like structures of maxillary region and sutures of midface.[1,2,3,4] In younger patients, SME is believed to allow the midface sutures to adapt at the maximum rate, with minimal tearing and bleeding compared to Rapid Maxillary Expansion (RME). Studies which provides histological evidence and on test animals indicate that slow expansion promotes suture preservation and can give a more stable outcome than rapid expansion.[5,6] Some scientific works also propose greater stability with slow expansion compared to rapid.[7]

Rapid Maxillary Expansion (RME) is commonly used to address maxillary deficiencies, often associated with crowded teeth, malocclusions (Class II and III), and temporomandibular joint dysfunction. Environmental and genetic factors contribute to maxillary underdevelopment. RME typically involves two activations daily, while SME progresses more gradually, with one activation every other day or less frequently. Both methods have distinct advantages and disadvantages.

With age, facial sutures become increasingly complex and intertwined, particularly after puberty, making their separation more challenging.[9] The maturation rate differs between sexes, with females generally reaching skeletal maturity earlier than males. After puberty, higher forces may be required to open sutures, potentially exceeding the physiological limits of adaptation.[10] The design of maxillary expanders is believed to influence the ratio of skeletal to dental expansion and treatment stability, though this assumption lacks robust evidence. Further research is needed to evaluate the effects of different SME devices independently.[11,12,13,14]

A systematic review by Agravere et al. analyzed SME without adjunctive procedures and concluded that definitive findings on skeletal and dental changes require control group comparisons.13 Despite this, SME seems to offer greater stability than RME, particularly with increasing age.

This case series explores the outcomes of slow and rapid maxillary expansion treatments, focusing on their respective effectiveness and implications.

This study's strengths include its large sample size, clear objective, and the use of Chi-square analysis, which provided statistically significant results. Stratifying by age allowed for valuable insights into the development of lip competency. However, the study's cross-sectional design limits its ability to establish causality, and it did not account for potential confounding factors such as oral habits. Additionally, the lack of long-term follow-up restricts the ability to observe trends over time. While the findings are generalizable to children in similar urban or clinical settings, they may not fully represent rural or diverse populations. Future research could focus on longitudinal studies, intervention strategies, and exploring other factors influencing lip competency, which would enhance the clinical application and understanding of these results.

CASE 1

A 9-year-old girl was referred to the Pediatric Dentistry Department at Krishnadevaraya Dental College, Bengaluru, with a complaint of forwardly erupting front teeth. External examination revealed a convex profile, while intraoral examination showed that the facial midline coincided with the dental midline.

She was in the mixed dentition stage and exhibited a Class I molar relationship with bimaxillary protrusion. The overjet measured over 6 mm, and a high-arched palate was observed. There was no deviation in the maxillary or mandibular midlines. Radiographs showed symmetrical condylar shapes in correct positions and the normal development of permanent successor tooth germs on both sides. The primary concern was

aesthetics. No family history of similar complaints was noted, and a detailed history revealed a mouth-breathing habit. No significant medical history was reported.

Based on these findings, a limited initial interceptive procedure was planned to restore standard bite alignment. Two treatment approaches were proposed: the use of an oral screen to address the mouth-breathing habit and a removable expansion appliance incorporating a jackscrew, anterior short labial bow, and bilateral posterior bite plane. An ENT consultation was conducted prior to prescribing the oral screen.

The child's guardians were trained to turn the jackscrew a quarter turn every other day. The child was instructed to wear the appliance throughout the day, except during meals and toothbrushing, and to use the oral screen while sleeping. Guardians were asked to ensure the child brushed her teeth and the appliance after each meal and before bedtime. The Roll's brushing technique was demonstrated, and the parents were advised to monitor brushing duration and frequency (at least two minutes). The child was also counseled on handling the appliance carefully and avoiding contact with wire extensions or edges during cleaning.

The patient was recalled every two weeks for clinical monitoring, and the labial bows were activated during each visit.

Upon completion of the treatment, a maxillary Hawley's retainer was prescribed to maintain the corrected occlusion. Informed consent for the treatment plan was obtained from the guardians, and they were advised that clinical re-evaluation would be necessary during the early permanent dentition stage.

Figure 1: Frontal view

Figure 2: Maxillary view

Figure 3: Mandibular view

Figure 4: Appliance view

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Figure 5: Intraoral expansion appliance

CASE 2

A 10-year-old girl was referred to the Pediatric Dentistry Department at Krishnadevaraya Dental College, Bengaluru, with complaints of pain in tooth 11 and irregular teeth, seeking treatment for both issues. A convex facial profile was noted, and the facial midline coincided with the dental midline in the maxilla.

The child exhibited a Class I molar relationship with bimaxillary protrusion in the mixed dentition stage. The overjet measured over 5 mm, and a high-arched palate was observed. There was no deviation of the maxillary or mandibular dental midlines. Radiographs revealed symmetrical condylar shapes and normally developing permanent successor tooth germs. The primary concern was pain management, which was linked to a history of trauma three days prior (a fall from a bicycle). A history of Ibuprofen allergy was also reported.

Based on these findings, root canal treatment (RCT) for tooth 11 was planned alongside an interceptive treatment approach to address malocclusion and restore normal occlusion. A maxillary expansion appliance with an anterior short labial bow and posterior bite plane was used.

The guardians were instructed to turn the jackscrew a quarter turn every alternate day, and the patient was provided with the same care instructions as outlined in Case 1.

Upon treatment completion, a Hawley's retainer was provided to maintain the corrected occlusion. Informed consent for the treatment plan was obtained from the guardians, who were advised that clinical re-evaluation would be necessary during the early permanent dentition stage.

Figure 6: Frontal view

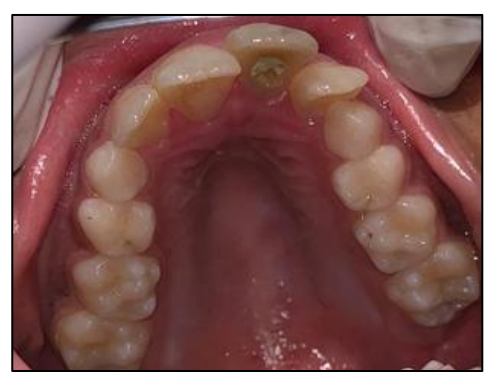

Figure 7: Maxillary view

Figure 8: Mandibular view

Figure 9: Appliance view

Figure 10: Intraoral expansion appliance

CASE 3

A 13-year-old girl was referred to the Pediatric Dentistry Department at Krishnadevaraya Dental College, Bengaluru, with a complaint of improper teeth alignment and a desire to correct it.

The patient was in the permanent dentition stage, but not all teeth were properly aligned or erupted due to a history of cleft lip and palate treatment. She exhibited a Class III molar relationship with maxillary retrusion and a mandibular overjet exceeding 6 mm. A deficiency in the palatal arch, crowding, and unerupted teeth were also noted, along with a deviation in the dental midline. Radiographs showed symmetrical condylar shapes.

Based on radiographic analysis and clinical findings, the treatment plan included the use of a fixed acrylic rapid maxillary expansion appliance combined with a Delaire's face mask and elastics. The child was instructed to wear the face mask as directed, and the guardians were trained to turn the jackscrew one and a half turns daily. The child was also educated on proper handling and maintenance of the appliance to ensure cleanliness and prevent damage. The combination of the rapid maxillary expansion appliance and the Delaire's mask was intended to achieve the desired results efficiently.

Upon completion of the treatment, a retainer was planned to maintain occlusal stability. Informed consent was obtained from the guardians, and they were advised that clinical re-evaluation would be necessary during the early permanent dentition stage.

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Figure 1: Intraoral maxilla

Figure 2: Intraoral Mandible

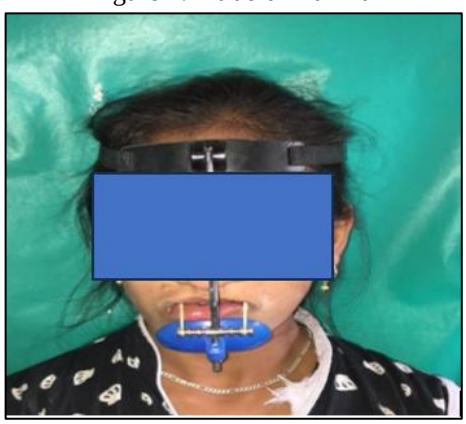

Figure 3: Delaire's mask – frontal view

Figure 4: Acrylized expansion appliance

DISCUSSION

The cases presented (Case 1 and Case 2) did not exhibit functional shifts, which aligns with findings from recent studies emphasizing the importance of early intervention during the mixed dentition phase. Early treatment during this phase provides a significant opportunity for guiding occlusion and addressing malocclusion, as delaying treatment until later developmental stages can lead to increased complexity (Kocadereli, 1998; Van de Velde et al., 2023.[15,16] Studies suggest that early intervention, particularly for crossbites, proclination, and crowding, is essential for achieving stable and successful outcomes (Urzal et al., 2023; Lombardo et al., 2020).[17,18]

A key factor in these treatments is determining the origin of malocclusion—whether dental or skeletal. In symmetrical arches, as observed in the first two cases, symmetrical expansion is beneficial and has been shown to offer more stable results when early correction is applied (Iodice et al., 2023).[19] Early maxillary expansion, especially with removable appliances, has proven effective in correcting crossbites and increasing intermolar width during the mixed dentition phase (Urzal et al., 2023; Alsawaf et al., 2022)[17, 20]. Rapid maxillary expansion (RME) can also expedite correction, making it particularly valuable for treating maxillary transverse deficiencies (Zhang et al., 2021).[21]

The treatment protocols used in the presented cases, including alternating day activation of the jackscrew, align with slow activation methods suggested by Osepchook & Kennedy (2005).[22] These protocols were effective and efficient in the first two cases, while daily activation protocols in the third case, using RME, facilitated faster correction, consistent with recent studies (Kennedy et al., 2021.[23] The recommended treatment duration with removable appliances generally ranges from 6 to 12 weeks, while slower expansion treatments may extend from 6 to 12 months depending on the case complexity (Kennedy et al., 2005; Pithon

et al., 2021).21,22

The type of appliance used and the patient's cooperation significantly influence the overall success of the treatment. It has been shown that early treatment with slow expansion procedures offers greater stability, especially in cases of anterior proclination with functional shifts (Iodice et al., 2023; Kucuk et al., 2021).[19,25] Furthermore, post-treatment retention is crucial for maintaining corrected occlusion. Retention periods of 4 to 6 months, or the duration needed to correct the malocclusion, are generally recommended (Kennedy et al., 2005).[22] Longer retention may be required depending on the stability of the occlusion and case-specific factors. Long-term studies indicate that early intervention with slow expansion methods leads to better occlusal stability (Van de Velde et al., 2023).[16]

Recent research underscores the importance of careful case selection and patient cooperation before initiating treatment, which significantly contributes to the success of both removable and fixed appliances in managing malocclusion, particularly in cases with functional shifts (Zhang et al., 2021; Kucuk et al., 2021).[21,25]

CONCLUSION

This case series highlights the effective use of simple removable and fixed appliances for the correction of malocclusions with and without functional shifts. Comprehensive clinical assessment and accurate diagnosis are critical for planning appropriate treatment strategies and designing appliances. These approaches provide clinicians and pediatric dentists with effective tools for managing similar malocclusion cases.

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Nil

CONFLICTS OF INTEREST

There are no conflicts of interest

REFERENCES

1. Profitt W. Contemporary orthodontics. St Louis: Mosby; 2000.
2. Bell RA. A review of maxillary expansion in relation to rate of expansion and patient's age. Am J Orthod 1982;81:32-7.
3. Hicks EP. Slow maxillary expansion. A clinical study of the skeletal versus dental response to low-magnitude force. Am J Orthod 1978;73:121-41.
4. Mew J. Relapse following maxillary expansion: a study of twenty five consecutive cases. Am J Orthod 1983;83:56-61. 27. Bell RA. The effects of maxillary expansion using a quad-helix appliance during the deciduous and mixed dentitions. Am J Orthod 1981;79:152-61.
5. Akkaya S, Lorenzon S, Ucem TT. Comparison of dental arch and arch perimeter changes between bonded rapid and slow maxillary expansion procedures. Eur J Orthod 1998;20:255-61.
6. Bell RA. The effects of maxillary expansion using a quad-helix appliance during the deciduous and mixed dentitions. Am J Orthod 1981;79:152-61.
7. Mossaz-Joelson K, Mossaz CF. Slow maxillary expansion: a comparison between banded and bonded appliances. Eur J Orthod 1989;11:67-76.
8. Srivastava SC, Mahida K, Agarwal C, Chavda RM, Patel HA. Longitudinal stability of rapid and slow maxillary expansion: a systematic review. J Contemp Dent Pract. 2020 Sep 1;21(1):1068-72.

9. Baccetti T, Franchi L, Cameron CG, McNamara JA Jr. Treatment timing for rapid maxillary expansion. Angle Orthod 2001;71:343-50.
10. Melsen B. Palatal growth studied on human autopsy material. A histologic microradiographic study. Am J Orthod 1975;68:42-54.
11. Schiffman PH, Tuncay OC. Maxillary expansion: a meta analysis. Clin Orthod Res 2001;4:86-96.
12. Petren S, Bondemark L, Soderfeldt B. A systematic review concerning early orthodontic treatment of unilateral posterior crossbite. Angle Orthod 2003;73:588-96.
13. Turpin DL. Dealing with posterior crossbite in young patients. Am J Orthod Dentofacial Orthop 2004;126:531-2.
14. Lagravere MO, Major PW, Flores-Mir C. Skeletal and dental changes with fixed slow maxillary expansion treatment: a systemic review. J Am Dent Assoc 2005;136:194-9.
15. Kocadereli I. Early treatment of posterior and anterior crossbite in a child. Am J Orthod Dentofacial Orthop. 1998;113(6):620-9.
16. Tse CS. Management of developing Class III malocclusion in the primary and early mixed dentitions. J Clin Orthod. 1997;31(9):535-41.
17. Urzal V, Iunes T, Pinhão-Ferreira A. A new challenge for crossbite treatment. Front Oral Health. 2023 Jul 6;4:1235134. doi: 10.3389/froh.2023.1235134.
18. Alsawaf DH, Almaasarani SG, Hajeer MY, Rajeh N. The effectiveness of the early orthodontic correction of functional unilateral posterior crossbite in the mixed dentition period: A systematic review and meta-analysis. Prog Orthod. 2022 Feb 14;23(1):5. doi: 10.1186/s40510-022-00398-4.
19. Lombardo G, Vena F, Negri P, et al. Worldwide prevalence of malocclusion in the different stages of dentition: A systematic review and meta-analysis. Eur J Paediatr Dent. 2020;21(2):115–122. doi: 10.23804/ejpd.2020.21.02.05.
20. Iodice G, Danzi G, Cimino R, Paduano S, Michelotti A. Association between posterior crossbite, skeletal, and muscle asymmetry: A systematic review. Eur J Orthod. 2023;45(1):10-19. doi: 10.1093/ejo/cjac066.
21. Kennedy DB, Osepchook M, Unrau J. Treatment timing for posterior crossbite correction. J Can Dent Assoc. 2021;87:1-10.
22. Pithon MM, Valarelli FP, Alves LA, et al. Effects of maxillary expansion with the hyrax appliance on facial aesthetics in patients with Class II malocclusion: A systematic review and meta-analysis. Orthod Craniofac Res. 2021;24(4):346-355. doi: 10.1111/ocr.12351.
23. Zhang X, Zhang Y, Xu T, et al. Three-dimensional evaluation of the effects of rapid maxillary expansion on maxillary and mandibular arch dimensions in growing patients. Am J Orthod Dentofacial Orthop. 2022;161(5):711-717. doi: 10.1016/j.ajodo.2022.01.029.
24. Kucuk Z, Kocak M, Yazar Y, et al. Comparison of rapid maxillary expansion and slow maxillary expansion in patients with transverse maxillary deficiency: A randomized controlled trial. J Orofac Orthop. 2021;82(2):211-220. doi: 10.1007/s00056-020-00261-9.

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