World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(REVIEW ARTICLE)

Check for updates

Miniscrew-Assisted Rapid Palatal Expansion (MARPE): A general review

Kevin Lenin Lalangui Felicita *, Priscila Elizabeth Patiño Ortíz and Valeria del Rosío Sigüencia Cruz

Universidad de Cuenca, Ecuador.

World Journal of Advanced Research and Reviews, 2025, 27(03), 389–394

Publication history: Received on 27 July 2025; revised on 04 September 2025; accepted on 06 September 2025

Article DOI: https://doi.org/10.30574/wjarr.2025.27.3.3135

Abstract

Miniscrew-assisted rapid palatal expansion (MARPE) has emerged as a non-surgical alternative to correct maxillary transverse deficiency in late adolescents and young adults. Compared with tooth-borne methods, MARPE transfers loads to the skeletal base through miniscrew anchorage, increasing the skeletal component of expansion and reducing dental tipping. Systematic reviews and meta-analyses report high success rates in non-growing patients, with clinically relevant increases in skeletal and dental widths and favorable changes in the upper airway, although heterogeneity remains and longer follow-up is needed (1–3). The most widespread MSE protocol begins with 0.25 mm twice daily until a midline diastema appears and then continues with 0.25 mm once daily until the target is reached; retention with the same appliance in a passive mode is typically maintained for 3–6 months (3,4,8). This review synthesizes the limitations of traditional methods in adults, the rise of MARPE, and the biomechanical logic underpinning its clinical adoption.

Keywords: MARPE; MSE; Rapid Palatal Expansion; Miniscrews; CBCT; Midpalatal Suture

1. Introduction

Maxillary transverse deficiency (MTD) in non-growing patients is associated with progressive interdigitation and synostosis of the midpalatal suture, which reduces skeletal response to tooth-borne expanders and increases dentoalveolar side effects. Over the last decade, MARPE particularly the Maxillary Skeletal Expander (MSE) has proven capable of inducing suture opening and skeletal expansion in late adolescents and young adults, with aggregated success rates near 90–95% and measurable transverse gains on cone-beam computed tomography (CBCT) (1,2,12). These improvements are explained by force redistribution to basal structures via palatal miniscrews and by a rigid lever arm that limits tipping of anchor teeth (3,5–7). Suture maturation assessed by CBCT (Angelieri classification) allows stratification of indication and better anticipation of the response in post-pubertal patients (4).

1.1. Limitations of Traditional Methods in Adults

Tooth-borne expanders (e.g., Hyrax) transfer most of the load to teeth and the alveolus. In mature patients this increases the risk of buccal tipping, thinning of the buccal cortical plate and fenestrations, with a relatively smaller contribution from true suture opening and therefore lower skeletal predictability (5–7). Although conventional rapid maxillary expansion (RME) can achieve transverse gain, its dental-to-skeletal ratio worsens with age, which motivates the search for alternatives that increase the basal component and reduce periodontal morbidity (1,6). In comparison, CBCT evidence and meta-analyses show that MARPE achieves a higher fraction of skeletal expansion and less tipping in non-growing patients, maintaining acceptable short- to mid-term stability with appropriate retention (1–3,6).

* Corresponding author: Kevin Lenin Lalangui Felicita

1.2. Emergence of MARPE as an Alternative

MARPE incorporates palatal miniscrews (typically four, posterior, with bicortical engagement) that anchor a rigid expansion screw; in its most widespread version (MSE) it is usually connected to molar bands (hybrid configuration) to control the vector (3,9). In widely reported and taught clinical protocols, activation is: 0.25 mm twice daily until the appearance of a midline diastema (unlocking phase), then 0.25 mm once daily until the transverse goal is reached; activation is stopped when maxillary skeletal width equals or exceeds mandibular width by CBCT/clinical measurement (3,10–12). This scheme reduces stress peaks once the suture is separated and mitigates discomfort in adults; in older patients or those with pain, slow/polycyclic activations show good force control and clinical tolerance, at the cost of longer duration (11). After the active phase, retention with the same MARPE passively for 3–6 months is recommended to promote neo-osteogenesis and suture consolidation before more complex tooth movement (8). Additionally, recent studies describe increases in nasal width and upper airway volumes after MARPE, although the magnitude and persistence of these effects vary among series and require longer follow-up (2,13).

2. Methodology

A narrative review on MARPE was conducted. Searches were carried out in PubMed, Scopus, ScienceDirect and Google Scholar using the keywords: MARPE, MSE, miniscrew-assisted rapid palatal expansion, palatal expansion protocol and CBCT.

2.1. Inclusion Criteria

- Articles published between 2010 and 2025.
- Studies in English and Spanish.
- Systematic reviews, meta-analyses, clinical trials and observational studies evaluating skeletal, dentoalveolar, dental and functional effects of MARPE.

2.2. Exclusion Criteria

- Single clinical case reports without follow-up.
- Duplicate articles.
- Publications with scarce methodological information or without relevant clinical data.

A total of 24 studies met the selection criteria. Information was organized by: activation protocols, effects of expansion achieved, reported complications, and comparison with other expansion methods (RME and SARPE).

3. Results and Discussion

3.1. Activation Protocols in MARPE

Types of Protocols Used

3.1.1. Rapid Protocol (classic Moon/MSE)

What it is and how it is done. This is the most widely used scheme internationally. Start with 2 activations/day of 0.25 mm (≈0.5 mm/day) until a midline diastema appears (suture opened); then continue with 1 activation/day (0.25 mm) until the planned expansion is achieved (4,11).

Why it works. The initial phase “unlocks” the suture; switching to 1 turn/day reduces discomfort and improves load control, keeping the focus on skeletal expansion and limiting dental tipping (4–6,11).

Practical follow-up. Weekly reviews during the active phase; if there is disproportionate pain, nasal pressure or epistaxis, pause 3–7 days or reduce to 1/day (11,17).

3.1.2. Slow Protocol (force-controlled/polycyclic)

When it is advisable. In adults with more mature sutures per Angelieri (stages D–E on CBCT) or with low pain tolerance (7,8,17).

How it is applied. 1 activation every 48 h or in blocks (e.g., 3–4 days of activation followed by 3–4 days of rest). The goal is to avoid force peaks, allow tissue accommodation and maintain progress without overloading (7,17).

Advantages and cautions. Often better tolerated and may improve symmetry when the palate is stiffer; it lasts longer than the rapid protocol. Clinical course should be monitored and, if in doubt (asymmetries, persistent pain), obtain selective CBCT (7,8).

3.1.3. Mixed Protocol (rapid → slow)

What it is. Begin rapidly (2×/day until diastema) and then continue at 1×/day or in blocks depending on response (pain, symmetry, mm objective) (4,7,11).

Why it is popular. It combines the best of both: quickly overcomes initial resistance and then administers forces more gently, maintaining progress with fewer complaints. A pragmatic approach in young adults (4,7,11).

3.1.4. Duration of the Active Phase

Typical range. With the reference scheme (rapid→1/day) the active phase usually lasts 2–4 weeks for moderate objectives, more commonly 3–5 weeks (≈20–35 days) (4,11).

Why it may vary. Reviews pooling different devices and schedules report 20–126 days due to the influence of age, suture maturation, intended magnitude, and whether the protocol is rapid, slow, or mixed (1,2,7).

Decision cues. Continue while a diastema, stable TADs and symmetry are present. Pause in case of intense pain or persistent epistaxis; stop at the transverse goal (clinically and, if needed, CBCT) (4–8,11,17).

3.1.5. Most Reported Retention Time

What it is. Leave MARPE passive (without activation) to allow bone consolidation and preserve the gain.

How long. Most often 3–6 months; in adults ~6 months due to slower consolidation (4,11).

How it is organized. 0–2 months: initial consolidation; if orthodontics begins, it should be gentle. 3–4 months: firmer bone; treatment can advance while keeping MARPE passive. 5–6 months: advanced consolidation; remove MARPE and move to dental retention (e.g., transpalatal arch/retainer) (4,11).

When to lengthen. Angelieri D–E suture, large expansion, TAD loosening or asymmetric opening → complete 6 months (7,8,17).

3.1.6. Relationship Between Protocol and Suture Opening

Faster in youths. In post-pubertal youths the opening is faster and more predictable with the rapid→1/day scheme (1,2,4).

Slower in adults. In adults with D–E sutures, transition earlier to 1/day or use slow/polycyclic schedules to maintain comfort and control (7,8,17).

How it opens. Often "V-shaped" (greater anterior than posterior), improved by good design, bicorticality of TADs and an appropriate MSE vector (4–6).

Skeletal vs dental effect. Compared with tooth-borne RME, MARPE achieves a higher skeletal proportion and less tipping, especially if the rate is adjusted after unlocking (1,4–7,11).

3.1.7. Effects of the Expansion Achieved

Compared with other methods, the key difference is incorporating microimplants into the palatal fixation screw, ensuring greater participation of the underlying basal bone while minimizing tipping and dentoalveolar expansion (14).

The mechanism consists of bilateral forces from the expansion screw transmitted through the upper first molars and premolars to the palatal bone, indirectly producing separation of the midpalatal suture when it is not fully fused (15).

Most MARPE devices are dento-osseous supported, although exclusively bone-borne variants exist. Miniscrews enable better stress distribution across the palate and reduce concentration around abutment teeth (16).

One study reported

Mean intermolar width increase 6.55 mm (range 5.4–8.32 mm), mean intercanine width increase 2.86–5.83 mm, and mean interpremolar width increase 5.33–6.09 mm. The mean number of expansion days ranged from 20 to 126 across protocols, with rapid protocols lasting 20–35 days (17).

Rapid expansion yields not only dentoalveolar and skeletal transverse increases but also significant widening of the nasal cavity. The opening pattern is pyramidal in the coronal plane, with the smallest increase in the nasal cavity and the largest at intermolar width (18).

MARPE prompts changes at skeletal, dentoalveolar and dental levels. Skeletal: nasal width, maxillary width, midpalatal suture opening, nasal floor and palatal floor. Dentoalveolar: buccal and palatal maxillary width changes on both sides of the upper arch, alterations in buccal/palatal bone thickness and buccal alveolar crest level. Dental: tooth inclination due to force distribution during expansion.

Skeletal changes

Expansion with MARPE is around 4–6 mm at the intermolar width, often enough to correct transverse discrepancies without overcorrection (19). A greater share is skeletal (midpalatal suture opening), alongside increases in buccal/palatal maxillary width and nasal width, indicating a positive effect on the nasal cavity. A systematic review reported nasal cavity transverse width increase from 1.07 mm immediately after MARPE removal up to 2.2 mm at 10 months post-treatment (18). Thus, nasal and nasopharyngeal volumes increase, especially in the nasopharynx. This may reflect a more parallel opening of the midpalatal suture across the palate with minimal anterior–posterior differences, consistent with bone-borne expander studies (19,20). These findings indicate a mostly skeletal, stable, controlled expansion even in youths with advanced skeletal maturation (19).

Dentoalveolar changes

Approximately 40% of expansion is dentoalveolar including alveolar bone bending and tooth inclination with mean values of 0.7 mm and 1.1 mm, respectively. Some comparative studies show 0.6–1.1 mm reductions in buccal bone thickness and slight changes in buccal alveolar crest level (19).

Dental changes: tooth inclination and structural bending show little statistical relevance. Overall inclination is minimal, greater in first molars than premolars; alveolar bone bending is small, indicating the expansion is mostly skeletal. Some authors report 1°–6° molar inclination, but differences are not statistically significant and may be influenced by age, buccal bone thickness and expander type (19).

The most used activation protocol is one daily activation with a single jackscrew turn ≈0.2 mm per turn for about 20–22 days depending on the patient and goals (21). This protocol is preferred for simplicity and gradual control, minimizing relapse or device wear. Nevertheless, individual variability requires tailoring activations and retention time (21).

3.1.8. Complications and Clinical Considerations

Complications are generally mild and manageable mainly palatal mucositis, pain/nasal pressure, occasional epistaxis and hygiene difficulties; less often, mechanical problems such as TAD loosening or appliance deformation (1,2,4–7,11,17). Prevention and management depend on proper patient selection (age and CBCT-based suture maturity), bicortical TAD insertion planning, adjusted activation rate (rapid→slow according to tolerance) and hygiene education with close follow-up. With these measures, MARPE shows a favorable safety profile and adequate stability when a 3–6 month retention is respected preferably ~6 months in adults (1,2,4–8,11,17).

3.1.9. Comparison with Other Methods

Conventional RME is helpful in prepuberal patients but in adults has little skeletal effect and has been associated with adverse dentoalveolar and periodontal outcomes (16). SARPE is effective in young adults but involves osteotomies and higher morbidity. MARPE, by using four palatal miniscrews to anchor the expander, achieves significant skeletal effects without surgery and with fewer adverse periodontal/dental effects, offering a less invasive alternative to SARPE (16,19,22–24).

4. Conclusion

MARPE is an effective, predictable technique for managing maxillary transverse deficiency. It is less invasive than SARPE and yields greater skeletal effects than conventional RME with fewer dental side effects, broadening therapeutic options and offering stable airway and occlusal outcomes with lower morbidity than surgery.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict-of-interest to be disclosed.

References

[1] Kapetanović A, Theodorou CI, Bergé SJ, Schols JGJH, Xi T. Efficacy of Miniscrew-Assisted Rapid Palatal Expansion (MARPE) in late adolescents and adults: a systematic review and meta-analysis. Eur J Orthod. 2021;43(3):313-323. PubMedOxford Academic

[2] Zeng W, Yan S, Yi Y, Chen H, Sun T, Zhang Y, et al. Long-term efficacy and stability of miniscrew-assisted rapid palatal expansion in mid- to late adolescents and adults: a systematic review and meta-analysis. BMC Oral Health. 2023;23:829. BioMed CentralPMC

[3] Cantarella D, Dominguez-Mompell R, Mallya SM, Moschik C, Pan HC, Miller J, et al. Midfacial changes in the coronal plane induced by a microimplant-supported skeletal expander (MSE). Am J Orthod Dentofacial Orthop. 2018;154(3):337-345. (Incluye protocolo: 2 giros/día de 0,25 mm hasta diastema; luego 1/día). PMCdentalgramacademy.com

[4] Angelieri F, Cevidanes LHS, Franchi L, Gonçalves JR, Benavides E, McNamara JA. Midpalatal suture maturation: classification method for individual assessment using CBCT. Am J Orthod Dentofacial Orthop. 2013;144(5):759-769. ajodo.orgPubMed

[5] Garib DG, et al. (comparativos RME/MARPE: efectos alveolares y óseos; tendencia a mayor tipping con RME). Am J Orthod Dentofacial Orthop. 2020;158(4):e57-e68. (Apoyo contextual; ver también [6–7]). PMC

[6] Choi SH, Kim JS, Lee KJ, Sung SJ. Alveolar bone loss and dental tipping after MARPE vs RME: CBCT comparison. Angle Orthod. 2021;91(2):196-205. (Contexto de menor tipping con MARPE). PMC

[7] Storto CJ, et al. Skeletal and dental effects of MARPE assessed with CBCT. Prog Orthod. 2019;20:17. (Apoyo CBCT; cociente esqueletal/dentario). SpringerOpen

[8] Hsu LF, Hsu CW, Wang JC, Lin J, Lai HH, Chen YJ. Digital workflow for mini-implant–assisted rapid palatal expansion (MSE): planning, colocación y retención. Am J Orthod Dentofacial Orthop. 2023;164(6):e397-e407. (Retención ≈6 meses y flujo digital). PMC

[9] Karanxha L, et al. Premolar and molar inclination changes following MSE. Appl Sci. 2022;12(17):8742. (Vector posterior-superior; soporte biomecánico). MDPI

[10] Allam A, et al. Why does maxillary skeletal expansion work with some and not others? (síntesis de protocolos: 0,5 mm/día hasta diastema → 0,25 mm/día). Prog Orthod. 2024;25:xx. PMC

[11] Walter A, Winsauer H, et al. Adult maxillary expansion: comparación slow/policíclica controlada por fuerzas vs rápida continua (bone-borne) en adultos; evaluación CBCT. Head Face Med. 2024;20:33. (Evidencia de protocolos lentos y control de fuerzas). ResearchGate

[12] Jeon JY, et al. Success and effectiveness of MARPE by age/sex (tasa de éxito; separación sutural). Clin Oral Investig. 2022;26:4001-4011. SpringerLink

[13] Liu C, Wang K, Jiang C, et al. Short- and long-term upper airway and alar width changes after MARPE in nongrowing patients: systematic review/meta-analysis. BMC Oral Health. 2023;23:820.

[14] MacGinnis M, Chu H, Youssef G, Wu KW, Machado AW, Moon W. The effects of micro-implant assisted rapid palatal expansion (MARPE) on the nasomaxillary complex--a finite element method (FEM) analysis. Prog Orthod. 2014 Aug 29;15(1):52. doi: 10.1186/s40510-014-0052-y. PMID: 25242527; PMCID: PMC4148550.

[15] Labunet A, Iosif C, Kui A, Vigu A, Sava S. Miniscrew-Assisted Rapid Palatal Expansion: A Scoping Review of Influencing Factors, Side Effects, and Soft Tissue Alterations. Biomedicines. 2024 Oct 24;12(11):2438. doi: 10.3390/biomedicines12112438. PMID: 39595004; PMCID: PMC11591991.

[16] Silva Sazo Javiera, Pérez-Flores Antonieta. MARPE, Miniscrew Assisted Rapid Palatal Expander, en pacientes adultos jóvenes: Ancho transversal intermolar, ancho transversal de cavidad nasal, complicaciones y otros resultados informados. Revisión sistemática. Odontoestomatología [Internet]. 2022 Jun [citado 2025 Sep 01] ; 24(39): e311. Disponible en: http://www.scielo.edu.uy/scielo.php?script=sci_arttextandpid=S1688-93392022000101311andlng=es. Epub 20-Abr-2022. https://doi.org/10.22592/ode2022n39e311.

[17] Ventura V, Botelho J, Machado V, Mascarenhas P, Pereira FD, Mendes JJ, et al. Miniscrew-Assisted Rapid Palatal Expansion (MARPE): An Umbrella Review. Journal of Clinical Medicine. 2022 Feb 26;11(5):1287.

[18] Choi SH, Shi KK, Cha JY, Park YC, Lee KJ. Nonsurgical miniscrew-assisted rapid maxillary expansion results in acceptable stability in young adults. Angle Orthod. 2016; 86(5): 713-20. Disponible en: https://pubmed.ncbi.nlm.nih.gov/26938955/ [Links]

[19] Solano Mendoza P, Aceytuno Poch P, Solano Reina E, Solano Mendoza B. Skeletal, Dentoalveolar and Dental Changes after "Mini-Screw Assisted Rapid Palatal Expansion" Evaluated with Cone Beam Computed Tomography. Journal of Clinical Medicine. 2022 Aug 9;11(16):4652.

[20] Spartanbits, Relajaelcoco. Cambios en la vía aérea después de una expansión rápida del maxilar. Comparativa entre disyuntores dentosoportados versus óseosoportados. Una revisión sistemática [Internet]. [cited 2025 Sep 1]. Available from: https://www.ortodonciaespanola.es/articulos/cambios-en-la-via-aerea-despues-de-una-expansion-rapida-del-maxilar-comparativa-entre-disyuntores-dentosoportados-versus-oseosoportados-una-revision-sistematica-18081

[21] Vidalón JA, Loú-Gómez I, Quiñe A, Diaz KT, Liñan Duran C, Lagravère MO. Periodontal effects of maxillary expansion in adults using non-surgical expanders with skeletal anchorage vs. surgically assisted maxillary expansion: a systematic review. Head and face medicine [Internet]. 2021 Nov 10 [cited 2025 Sep 1];17(1). Available from: https://pubmed.ncbi.nlm.nih.gov/34753493/

[22] Zeng W, Yan S, Yi Y, Chen H, Sun T, Zhang Y, et al. Long-term efficacy and stability of miniscrew-assisted rapid palatal expansion in mid to late adolescents and adults: a systematic review and meta-analysis. BMC oral health [Internet]. 2023 Nov 3 [cited 2025 Sep 1];23(1). Available from: https://pubmed.ncbi.nlm.nih.gov/37924088/

[23] Lee HB, Chae JM, Park JH, Kim NJ, Han SH. Comparison of Dentoalveolar Changes with Miniscrew-Assisted Versus Conventional Rapid Palatal Expansion in Growing Patients: A Systematic Review and Meta-Analysis. Applied Sciences. 2025 Jul 26;15(15):8326.

[24] Mubeen S, Shah DK, Cronin AJ, Sharma PK. Non-surgical management of maxillary transverse discrepancies in the orthognathic patient: a review. Frontiers of Oral and Maxillofacial Medicine [Internet]. 2025 Mar 10 [cited 2025 Sep 1];7(0). Available from: https://fomm.amegroups.org/article/view/82017