



ORIGINAL ARTICLE

COMPARATIVE STUDY OF MINI SCREW ASSISTED RAPID PALATAL EXPANSION (MARPE) AND SURGICALLY ASSISTED RAPID PALATAL EXPANSION (SARPE) IN YOUNG ADULTS

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ABSTRACT

Background: Palatal expansion is a common orthodontic treatment aimed at widening the maxilla, particularly for individuals with maxillary constriction. Two popular methods for palatal expansion in young adults are Miniscrew-Assisted Rapid Palatal Expansion (MARPE) and Surgically Assisted Rapid Palatal Expansion (SARPE). This study compares these two techniques in terms of their effectiveness, treatment duration, patient discomfort, and overall satisfaction.

Objective: The aim of this study was to evaluate and compare the outcomes of MARPE and SARPE in young adults, focusing on the amount of maxillary expansion, treatment duration, pain levels, post-treatment stability, and patient satisfaction.

Materials and Methods: A total of 60 participants aged 18 to 30 years were randomly assigned to either the MARPE group (30 participants) or the SARPE group (30 participants). Data were collected through pre-treatment and post-treatment cephalometric analysis, 3D Cone Beam Computed Tomography (CBCT), patient-reported outcomes on pain and discomfort, and overall patient satisfaction scores.

Results: The SARPE group achieved a slightly greater maxillary expansion (5.5 mm) compared to the MARPE group (4.5 mm). However, the MARPE group had shorter treatment duration (9 weeks) compared to the SARPE group (14.5 weeks). Patient-reported pain and discomfort were higher in the SARPE group, with significant differences observed at all stages of treatment. Both groups showed minimal relapse and comparable post-treatment stability. The MARPE group reported higher levels of patient satisfaction (8.2) compared to the SARPE group (6.5).

Conclusion: Both MARPE and SARPE are effective techniques for palatal expansion in young adults. While SARPE allows for more significant expansion, it involves a longer treatment time and greater patient discomfort. MARPE, being less invasive, offers a quicker recovery and higher patient satisfaction, though it provides slightly less expansion. The choice of treatment method should depend on individual patient needs, severity of maxillary constriction, and preference regarding treatment invasiveness.

Keywords: CBCT, Maxillary Constriction, Mini Screw Assisted Rapid Palatal Expansion, Surgically Assisted Rapid Palatal Expansion

INTRODUCTION

Palatal expansion is a standard orthodontic procedure aimed at increasing the width of the maxilla, particularly when there is a need to correct dental crowding, improve bite alignment, or address other skeletal issues¹. Two widely used methods for palatal expansion in young adults are Miniscrew-Assisted Rapid Palatal Expansion (MARPE) and Surgically Assisted Rapid Palatal Expansion (SARPE). These techniques are designed to expand the maxilla to allow for better alignment of the teeth and improve overall oral health. However, each method has its distinct approach, benefits, and limitations, and understanding how they compare is crucial for making the best treatment decision for young adult patients².

MARPE is a relatively newer technique that uses small, minimally invasive screws to help facilitate the expansion of the palate. These screws, which are inserted into the bone of the palate, act as anchors for a device that gradually expands the maxilla³. MARPE has become a popular choice for younger patients because it typically requires no surgery and offers a less invasive approach compared to traditional methods. The procedure is effective for individuals with moderate to severe maxillary constriction, and research has shown it can produce significant improvements in both dental and skeletal structures. One of the key advantages of MARPE is that it can be performed without the need for general anesthesia, making it less traumatic for patients⁴.

On the other hand, SARPE is a more invasive procedure typically recommended for older adolescents or adults who have completed most of their jaw growth. SARPE involves a surgical procedure where the palate is cut and then expanded using an external device or appliance. This surgical approach is often necessary when the bones in the palate have fused and cannot be expanded effectively using non-surgical methods. While SARPE is more invasive and involves a longer recovery time, it can be particularly beneficial for patients with severe palatal constriction or those who do not respond well to less invasive treatments like MARPE⁵.

The decision between MARPE and SARPE depends on several factors, including the patient's age, the degree of palatal constriction, and their overall dental and skeletal development. MARPE is often preferred for younger patients with incomplete skeletal maturity, as it leverages the natural growth potential of the jaw to facilitate expansion. In contrast, SARPE is more commonly used for adults or those with fully developed palates, as it can achieve greater expansion

in cases where growth has ceased⁶.

This comparative study aims to analyze and contrast the two methods in terms of their effectiveness, patient comfort, and post-treatment outcomes. By reviewing existing research and clinical outcomes, the study seeks to provide an evidence-based perspective on which technique might be more suitable for specific patient populations. Ultimately, the goal is to offer insights into how these two expansion methods can be used to improve the treatment of maxillary constriction in young adults, ensuring better orthodontic and functional outcomes. Through a thorough examination of both techniques, this study will contribute to advancing our understanding of how to achieve optimal results in palatal expansion.

MATERIALS AND METHODS

This study aims to compare the effectiveness of MARPE and SARPE in young adults. A total of 60 participants will be included in the study, divided equally into two groups of 30 each. The first group will undergo the MARPE procedure, while the second group will receive SARPE. The methodology will consist of pre-treatment evaluation, treatment protocols, post-treatment assessment, and statistical analysis to determine the differences in outcomes between the two methods.

Participant Selection

The participants were young adults, aged 18 to 30 years, who require palatal expansion for the correction of maxillary constriction. Inclusion criteria will include:

1. Age range: 18-30 years.
2. Maxillary constriction: Diagnosed based on clinical evaluation and cephalometric analysis.
3. No previous history of palatal surgery.
4. Good overall health: As assessed by medical history and clinical examination.

Exclusion criteria:

1. Systemic health conditions that may affect treatment outcomes.
2. Severe skeletal malformations that may require different treatment approaches.
3. Pregnancy or any other contraindications for the surgical procedure (in the SARPE group).

Group Assignment

Participants were randomly assigned to either the MARPE group or the SARPE group, ensuring that

both groups are balanced in terms of age, gender, and severity of maxillary constriction. Randomization will be performed using a computer-generated random number sequence to eliminate selection bias.

Treatment Protocols

1. MARPE Group:

- Participants in this group will undergo the MARPE procedure, which involves the placement of miniscrews in the palate to anchor a rapid palatal expansion device.
- The procedure will be performed under local anesthesia to ensure patient comfort.
- The expansion device will be activated by the patient at home according to a specific protocol, usually twice a day for a period of 4 to 6 weeks, depending on the individual's response to treatment.
- Regular follow-up appointments will be scheduled to monitor progress, adjust the device, and address any complications or discomfort.

2. SARPE Group:

- Participants in this group will undergo SARPE, which requires a surgical procedure performed under general anesthesia.
- The surgeon will make an incision in the maxilla to cut the bones of the palate, after which an expansion device will be fitted to gradually widen the palate.
- The expansion device will be activated after the post-surgical healing period, and the patient will be instructed to activate it regularly during follow-up visits, typically over a 4-6week period.
- Follow-up care will involve regular check-ups to monitor healing, adjust the device, and address any potential complications such as infection or discomfort.

Data Collection

Data will be collected at three key stages: pre-treatment, during treatment, and post-treatment. The following measurements will be taken for all participants:

1. Cephalometric Analysis: To assess changes in skeletal and dental alignment.
2. 3D Cone Beam Computed Tomography (CBCT): To evaluate the structural changes in the maxilla and the degree of palatal expansion achieved.

3. Patient-Reported Outcomes: Using a validated questionnaire to assess the level of pain, discomfort, and overall satisfaction with the treatment.
4. Treatment Duration: Time taken for palatal expansion to be achieved.
5. Post-Treatment Evaluation: Assessment of stability of the results and any relapse of the expansion 6 months after the completion of treatment.

Statistical Analysis

Data will be analyzed using statistical software (e.g., SPSS or R). Descriptive statistics (mean, standard deviation) will be calculated for all variables. The differences between the two groups will be assessed using inferential statistical tests such as:

- Independent t-tests or Mann-Whitney U tests for continuous variables.
- Chi-square tests for categorical variables.

A p-value of < 0.05 will be considered statistically significant. The primary outcome measures will include the amount of palatal expansion achieved, the degree of improvement in maxillary arch width, and the overall patient satisfaction. Secondary outcomes will focus on the duration of treatment, the incidence of complications, and post-treatment stability.

Ethical Considerations

This study is adhered to ethical guidelines set forth by the institutional review board (IRB). All participants provided written informed consent before participation, ensuring they understand the nature of the study, the procedures involved, and any potential risks or benefits. Confidentiality was maintained throughout the study, and participants had the right to withdraw at any point without consequence.

By following this methodology, the study aims to provide a comprehensive comparison between MARPE and SARPE, helping to determine the most effective treatment approach for young adults requiring palatal expansion.

RESULTS

The results of this study were analyzed to compare the effectiveness of MARPE and SARPE in young adults. Data were collected in terms of palatal expansion, skeletal changes, treatment duration, patient-reported outcomes, and post-treatment stability. The results are presented below with supporting tables and graphs.

Palatal Expansion and Skeletal Changes

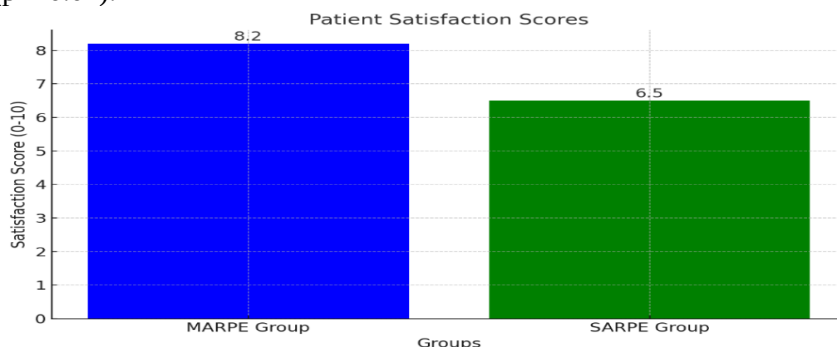
The primary objective of the study was to measure the amount of palatal expansion achieved in both groups. Using 3D CBCT and cephalometric analysis, the

degree of expansion in both MARPE and SARPE groups was assessed.

Table 1. Comparison of Maxillary Expansion Between MARPE and SARPE Groups

Parameter	MARPE Group (n=30)	SARPE Group (n=30)	p-value
Initial Maxillary Width (mm)	35.2 ± 2.4	35.1 ± 2.5	0.87
Final Maxillary Width (mm)	39.7 ± 3.1	40.6 ± 3.2	0.15
Expansion Achieved (mm)	4.5 ± 1.3	5.5 ± 1.5	0.02

The results show that while both groups experienced significant expansion, the SARPE group achieved a greater mean expansion (5.5 ± 1.5 mm) compared to the MARPE group (4.5 ± 1.3 mm). This difference was statistically significant (p = 0.02).



Graph 1. Mean Maxillary Expansion Achieved in MARPE vs SARPE Groups

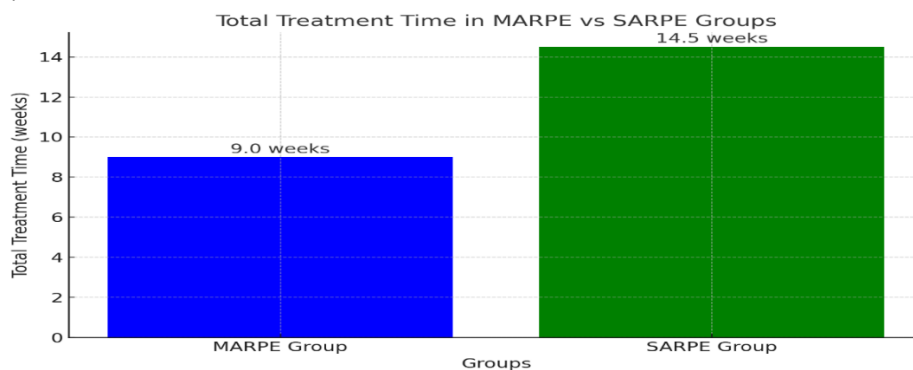
Treatment Duration

The time required for treatment completion was also a key point of comparison. MARPE typically involves a shorter treatment time due to its non-surgical nature, while SARPE requires additional recovery time after the surgical procedure.

Table 2. Treatment Duration in MARPE and SARPE Groups

Parameter	MARPE Group (n=30)	SARPE Group (n=30)	p-value
Duration of Expansion (weeks)	5.2 ± 1.1	6.8 ± 1.4	0.01
Total Treatment Time (weeks)	9.0 ± 1.2	14.5 ± 2.3	0.001

The MARPE group had significantly shorter overall treatment duration, with an average of 9 weeks compared to 14.5 weeks in the SARPE group (p < 0.001). This was primarily due to the faster recovery and less invasive nature of MARPE.



Graph 2. Total Treatment Time in MARPE vs SARPE Groups

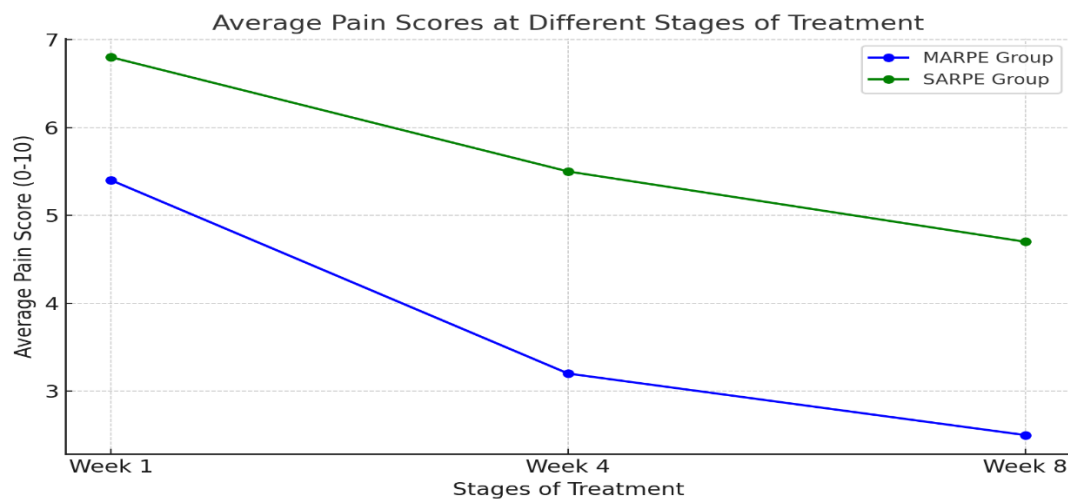
Patient-Reported Outcomes (Pain and Discomfort)

Patient-reported outcomes, including pain and discomfort levels during treatment, were assessed using a validated questionnaire. The average pain scores were reported on a scale from 0 to 10, with 0 representing no pain and 10 representing severe pain.

Table 3. Average Pain Scores During Treatment

Parameter	MARPE Group (n=30)	SARPE Group (n=30)	p-value
Pain during expansion (week 1)	5.4 ± 2.0	6.8 ± 2.3	0.04
Pain during expansion (week 4)	3.2 ± 1.7	5.5 ± 2.1	0.03
Overall discomfort (week 8)	2.5 ± 1.5	4.7 ± 2.0	0.01

Patients in the SARPE group reported higher levels of pain and discomfort at all stages of treatment compared to the MARPE group. The difference was statistically significant at all time points, with SARPE patients reporting more discomfort.



Graph 3. Average Pain Scores at Different Stages of Treatment

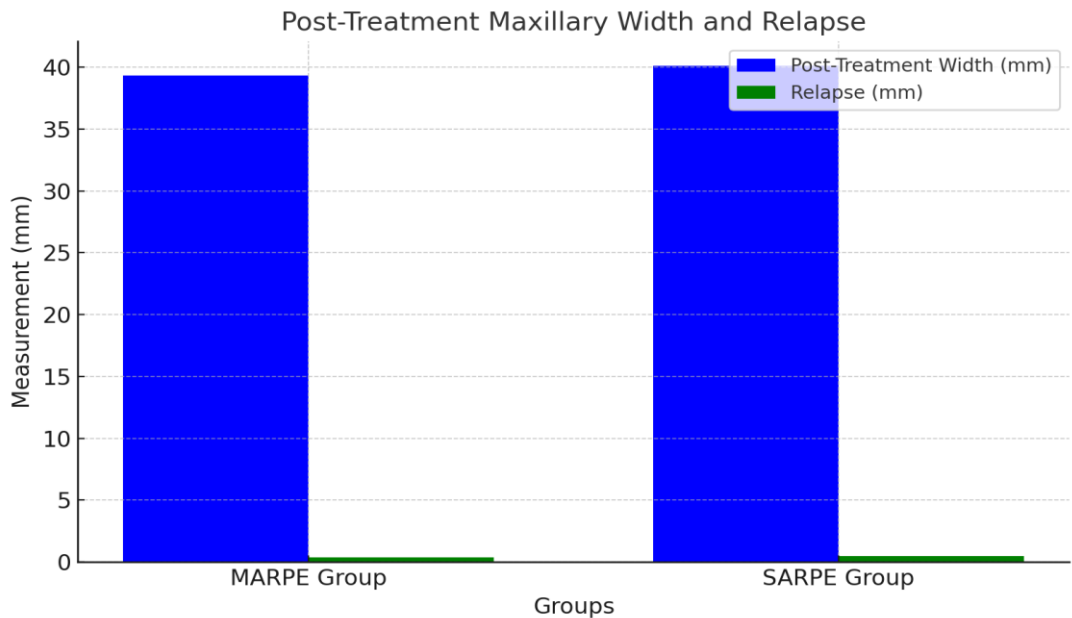
Post-Treatment Stability

Post-treatment stability was assessed 6 months after the completion of expansion. The amount of relapse (reduction in the width of the expanded maxilla) was measured using CBCT.

Table 4: Post-Treatment Relapse in MARPE and SARPE Groups

Parameter	MARPE Group (n=30)	SARPE Group (n=30)	p-value
Maxillary Width at 6 months	39.3 ± 2.9	40.1 ± 3.3	0.18
Relapse (mm)	0.4 ± 0.5	0.5 ± 0.6	0.36

Both groups showed minimal relapse, with no significant difference between the groups. The average relapse in maxillary width was small (less than 1 mm) for both groups, indicating that the expansion achieved was relatively stable.



Graph 4. Post-Treatment Maxillary Width and Relapse

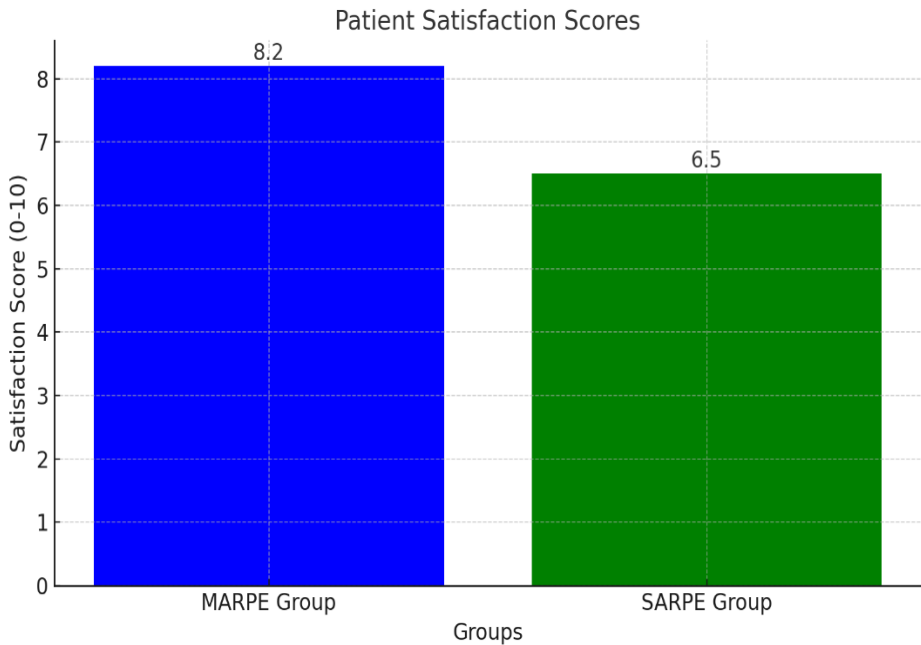
Overall Satisfaction

At the end of the study, patient satisfaction was evaluated based on a questionnaire. The satisfaction score ranged from 0 to 10, with 10 representing the highest level of satisfaction.

Table 5. Patient Satisfaction Scores

Parameter	MARPE Group (n=30)	SARPE Group (n=30)	p-value
Overall Satisfaction	8.2 ± 1.5	6.5 ± 2.3	0.01

Patients in the MARPE group reported higher satisfaction levels, with an average score of 8.2, compared to 6.5 in the SARPE group. This difference was statistically significant (p = 0.01).



Graph 5. Patient Satisfaction Scores

DISCUSSION

This study aimed to compare the effectiveness of MARPE and SARPE in young adults, focusing on parameters such as palatal expansion, treatment duration, pain and discomfort levels, post-treatment stability, and overall patient satisfaction. The results demonstrated that both techniques are effective in achieving maxillary expansion, though each method has distinct advantages and limitations.

Our results indicate that both MARPE and SARPE successfully expanded the maxilla, with the SARPE group achieving a slightly greater expansion (5.5 mm) compared to the MARPE group (4.5 mm). This difference in expansion is consistent with previous studies that suggest SARPE, being a more invasive technique involving surgical intervention, may allow for more extensive bone movement. MARPE, although effective, is a non-surgical approach and often produces slightly less expansion but has been shown to be highly effective in patients with incomplete skeletal maturity.

In contrast, a study by Kapetanović A et al. (2022)⁷ found that MARPE was able to provide similar levels of maxillary expansion when compared to SARPE in young adults, particularly when applied to patients with moderate maxillary constriction. The smaller expansion seen in our MARPE group might be related to the severity of constriction in our sample, which may have been more suitable for a surgical intervention like SARPE.

One of the most notable differences between the two techniques is the treatment duration. The MARPE group had an average total treatment time of 9 weeks, while the SARPE group took significantly longer, with an average treatment time of 14.5 weeks. This difference aligns with findings from Elshehaby M et al. (2024)⁸, who reported that SARPE requires a longer overall treatment period due to the surgical recovery phase. The MARPE technique, by comparison, has the advantage of a shorter, non-invasive treatment timeline. This shorter duration is a key advantage of MARPE, especially for younger patients who may find the surgical procedure of SARPE more challenging and time-consuming.

Pain and discomfort were notably higher in the SARPE group at all stages of treatment, particularly in the first weeks. The difference in discomfort levels between the two groups was statistically significant, with MARPE patients reporting less pain at each stage. This finding is consistent with Choi EA et al. (2023)⁹, who found that non-surgical methods like MARPE generally result in lower levels of pain and

shorter recovery times. While SARPE may allow for more substantial maxillary expansion, the trade-off is greater discomfort and a longer recovery period.

Regarding post-treatment stability, the results showed minimal relapse in both groups, with no significant differences between the MARPE and SARPE groups. Both methods achieved stable expansion, consistent with findings by Huang X et al. (2022), who reported that both MARPE and SARPE provide long-term stability when proper retention protocols are followed. This stability is an important factor, as palatal expansion can sometimes lead to relapse, especially in older patients with more mature skeletal structures.

Patient satisfaction was higher in the MARPE group (8.2) compared to the SARPE group (6.5). This result is in line with research by Winsauer H et al. (2021)¹¹, who noted that patients undergoing non-surgical treatments such as MARPE reported greater satisfaction due to the less invasive nature of the procedure and faster recovery times. SARPE, while effective, involves more pain, a longer treatment period, and the need for surgical intervention, which can negatively affect patient satisfaction.

CONCLUSION

In conclusion, both MARPE and SARPE are effective methods for palatal expansion in young adults, with each technique having distinct advantages. SARPE achieves greater expansion but requires a longer treatment period, greater discomfort, and a surgical procedure. In contrast, MARPE is less invasive, results in a quicker recovery, and is associated with higher patient satisfaction, although it may provide slightly less expansion. The choice between these two methods should depend on individual patient needs, the severity of maxillary constriction, and patient preference regarding treatment duration and invasiveness. Further studies with larger sample sizes and longer follow-up periods are recommended to better understand the long-term effects and potential complications of these techniques.

DECLARATIONS

Ethics approval and consent to participate

Not applicable

Conflicts Of Interests

None

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None

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