

Hard Tissue Evaluation after Microimplant Assisted Rapid Palatal Expansion

INTRODUCTION

- Microimplant-assisted rapid palatal expanders (MARPEs) allow the clinician to achieve transverse skeletal expansion of the palate with minimal flaring of the teeth.¹
- Maxillary expansion directly or indirectly affects the following neighboring structures: the maxilla, mandible, nasal cavity, pharyngeal structures, and the pterygoid processes of the sphenoid bone.²

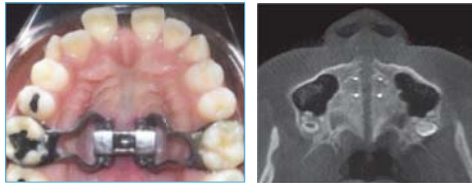


Figure 1. Clinical photo of MARPE appliance (left)³ and CBCT following rapid palatal expansion (right).

- Past studies have demonstrated a positive correlation between increases in nasal cavity width and decreases in nasal airway resistance, which may improve nasal ventilation.⁴
- Rapid palatal expansion has been shown to follow a triangular pattern in the frontal plane with the greatest increase at the dental level and the least at the level of the orbits.⁵
- Although parallelism of suture opening is not clearly defined by current literature, a parallel pattern of suture opening in the axial view has been observed.⁵

OBJECTIVE

- To evaluate the concurrent hard tissue changes of the nasal cavity as a result of palatal skeletal expansion using MARPEs.

MATERIALS & METHODS

- Retrospective Study
- Records collected from the University of the Pacific Arthur A. Dugoni School of Dentistry Graduate Orthodontic clinic and one private practice

Inclusion criteria:

- Expansion achieved with MARPE appliances using four microimplants for bone anchorage
- Initial (T1) and post-expansion (T2) cone beam computed tomography (CBCT) records

Sample:

- 35 subjects
 - 23 females (65.7%) and 12 males (34.3%)
 - Age range between 10-28 years; Average: 17 ± 4.8 years
- T2 recorded an average of 6.3 ± 5.6 months following completed expansion

Method:

- 6 judges (one orthodontic resident and 5 second-year DDS students) used Anatomage InVivo6® 3D Imaging Software to locate 18 hard tissue landmarks to generate a 3D analysis

Statistics:

- ICC was used for landmark reliability.
- A paired t-test and Wilcoxon signed-rank test were used to analyze the data.



Figure 2. Tracing points of the posterior nasal cavity (left) and anterior nasal cavity (right).

RESULTS

Table 1: Hard tissue measurements with expansion

Nasal Cavity	T1	T2	T2-T1	p-value
Lat_Pirif-Lat_Pirif	17.94 ± 2.82	19.71 ± 2.99	1.77 ± 1.59	<0.001
Inf_Pirif-Inf_Pirif	18.21 ± 3.23	20.58 ± 3.1	2.36 ± 2.91	<0.001
ANC IT-IT	20.99 ± 2.37	23.37 ± 2.94	2.38 ± 1.45	<0.001
PNC ST-ST	21.84 ± 2.93	22.53 ± 3.14	0.69 ± 1.21	0.002
PNC IT-IT	25.66 ± 2.37	26.99 ± 2.27	1.34 ± 1.6	<0.001
PNC NF-NF	24.54 ± 5.41	27.28 ± 2.6	2.75 ± 5.12	<0.001

All measurements are linear measurements in mm. p < 0.05 is considered significant.
 Lat_pirif = lateral piriform
 Inf_pirif = inferior piriform
 ANC IT = anterior nasal cavity inferior turbinate
 PNC ST = posterior nasal cavity superior turbinate
 PNC IT = posterior nasal cavity inferior turbinate
 PNC NF = posterior nasal cavity nasal floor

- Differences between T1 and T2 were found to be significant for all measurements.
- The highest amount of expansion was achieved at the following inferior points: inferior piriform, inferior turbinate of the anterior nasal cavity and the nasal floor.
- The lowest amount of expansion was achieved at the most superior measurement at the superior turbinate.
- Transverse expansion occurred at both the anterior and posterior portion of the nasal cavity at the level of the inferior turbinate, but more in the anterior compared to the posterior.

CONCLUSION

- Maxillary expansion using MARPE resulted in anterior and posterior palatal suture opening, as well as an increase in the width of the nasal cavity in the anterior, posterior, inferior, and superior dimensions.
- The differences in the amount of expansion in the coronal plane between superior and inferior points reflect a triangular-shaped transverse expansion with its apex at the most superior position.
- Expansion of the nasal cavity at the level of the inferior turbinate in the axial plane reflects a parallel pattern of suture expansion, which favors the anterior more than the posterior.

CLINICAL IMPLICATION

- Expansion of the nasal cavity as a result of MARPE may aid in treatment of patients with nasal airway resistance.

FUTURE DIRECTIONS

- More studies need to be done to evaluate the long term stability of these hard tissue changes.
- Overlying soft tissue changes as a result of skeletal expansion should be further examined.
- Further investigation is needed to determine how expansion of the maxilla and corresponding nasal structures may benefit patients with nasal airway resistance.
- Different age groups should be considered when further studying the effects of MARPE.
- Positioning of microimplants may play a role in influencing the pattern of suture opening and should be considered in a future study.

REFERENCES

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