

## BACKGROUND

The maxillary expansion has long been used in children and adolescents to correct the transverse discrepancies and dental crowding<sup>1</sup>. Although the sutural separation is usually accomplished through mid-adolescence, it is often followed by dental tipping in the posterior teeth<sup>2</sup>. Those young patients are commonly treated with conventional rapid palatal expansion (RPE). However, they still have remaining mandibular growth, which can influence the treatment plan and outcome, especially in a high vertical mandibular plane tendency. A question remains: can this temporary buccal tipping of the molar lead to an alteration in growth that worsens the mandibular plane angle? As an alternative, the micro-implant assisted palatal expansion (MARPE)<sup>3</sup>, is believed to produce a more parallel expansion without molar buccally tipping. For this reason, this study aimed to assess the skeletal differences in growing patients treated with RPE or MARPE.

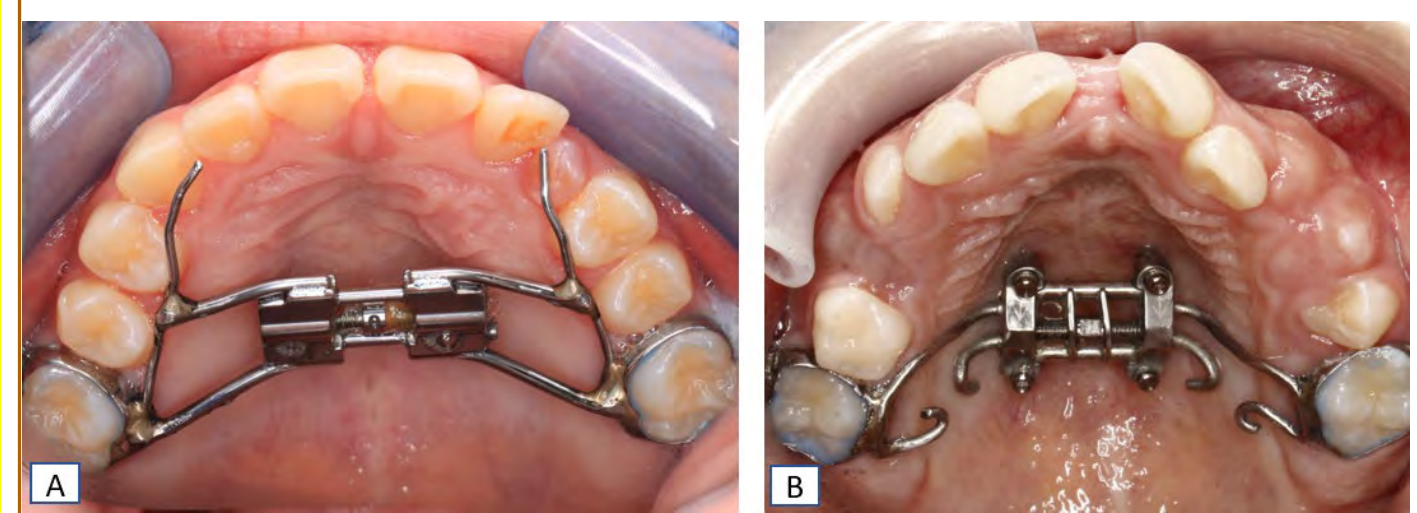


Fig. 1 – RPE (A) and MARPE (B) appliances installed in different patients

## OBJECTIVES

To assess the cephalometric and transversal changes in growing patients using RPE and MARPE. Our hypothesis is that there are no significant differences between the two groups for the molar inclination, maxilla expansion amount, and mandibular plane changes

## MATERIAL AND METHODS

**IRB APPROVAL:** This study was approved by the IRB of the University of the Pacific (UoP), number: IRB2021-97

**SAMPLE:** We collected the CBCT scans of 17 MARPE and 20 RPE patients at two different time points: initial orthodontic treatment (T1) and final (T3)

**CBCT ASSESSMENT:** The Dolphin® software was used to orient the skulls (Fig 1) and trace the lateral cephalograms (Fig 2) and assess the maxillary transversal and upper molar changes (Fig 3). A total of 32 measurements were analyzed.

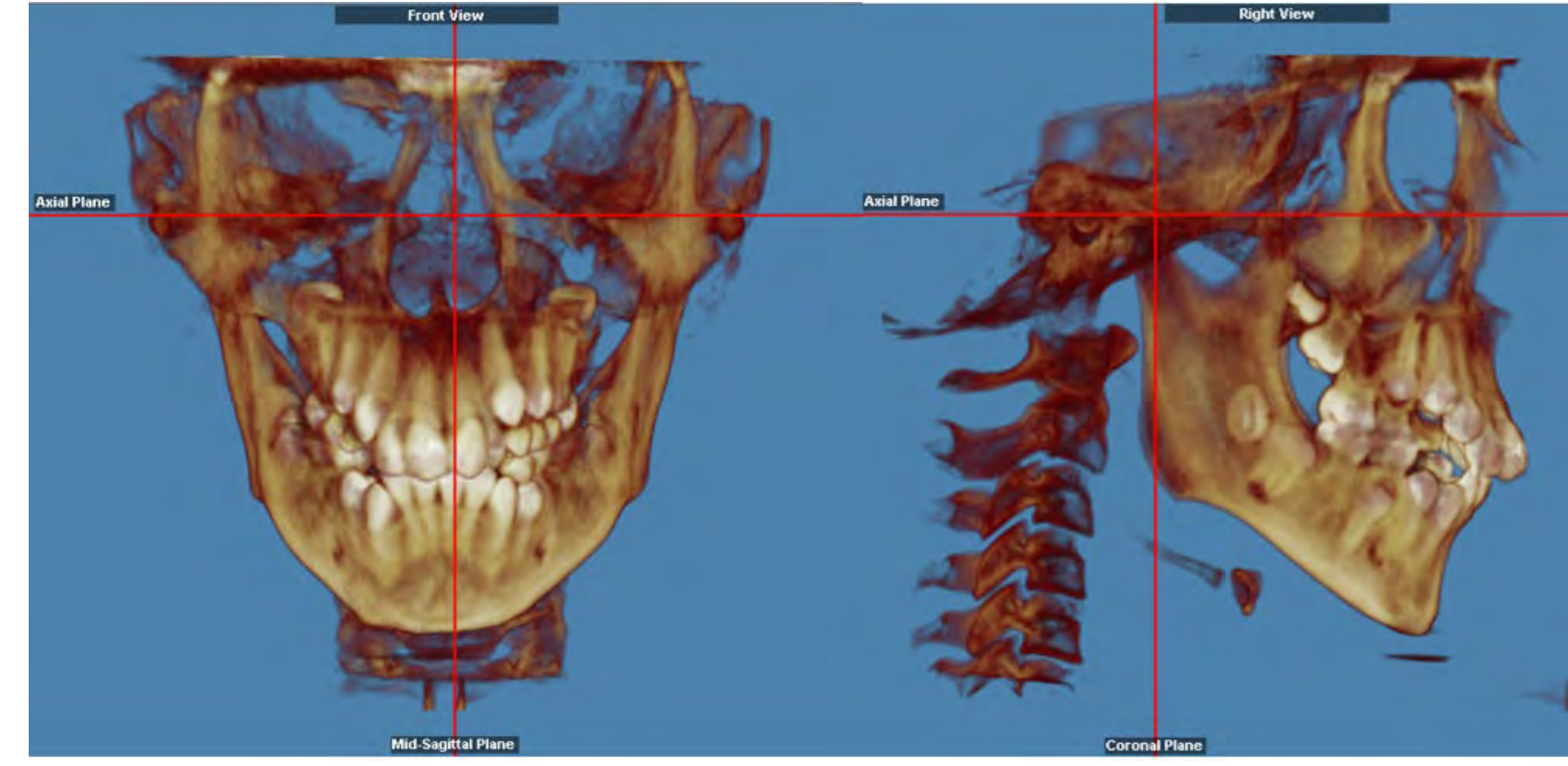


Fig. 2 Head orientation using Dolphin software.

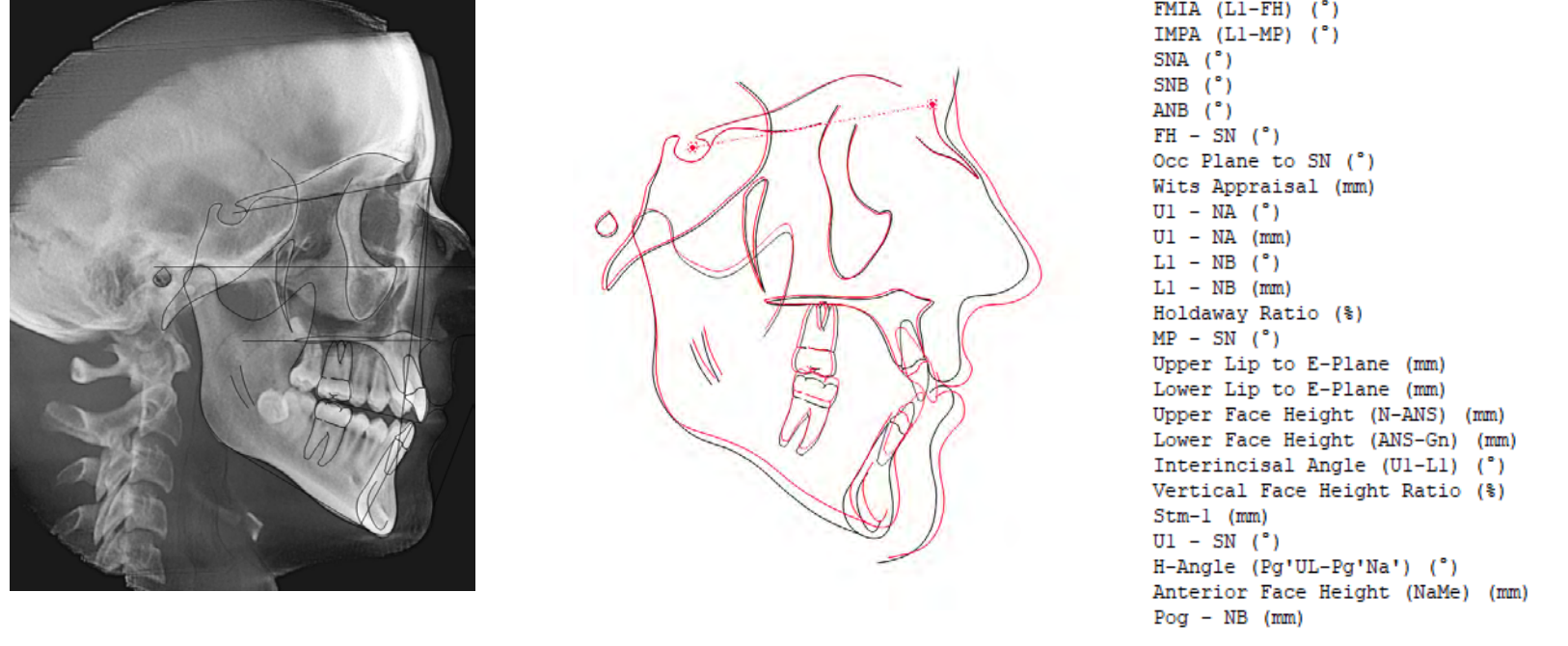


Fig. 3 – RPE patient. The image on the left shows the cephalogram traced in T1. On the right, the superposition T1 (black) and T2 (red) are shown. The cephalometrics measurements also are shown in the right

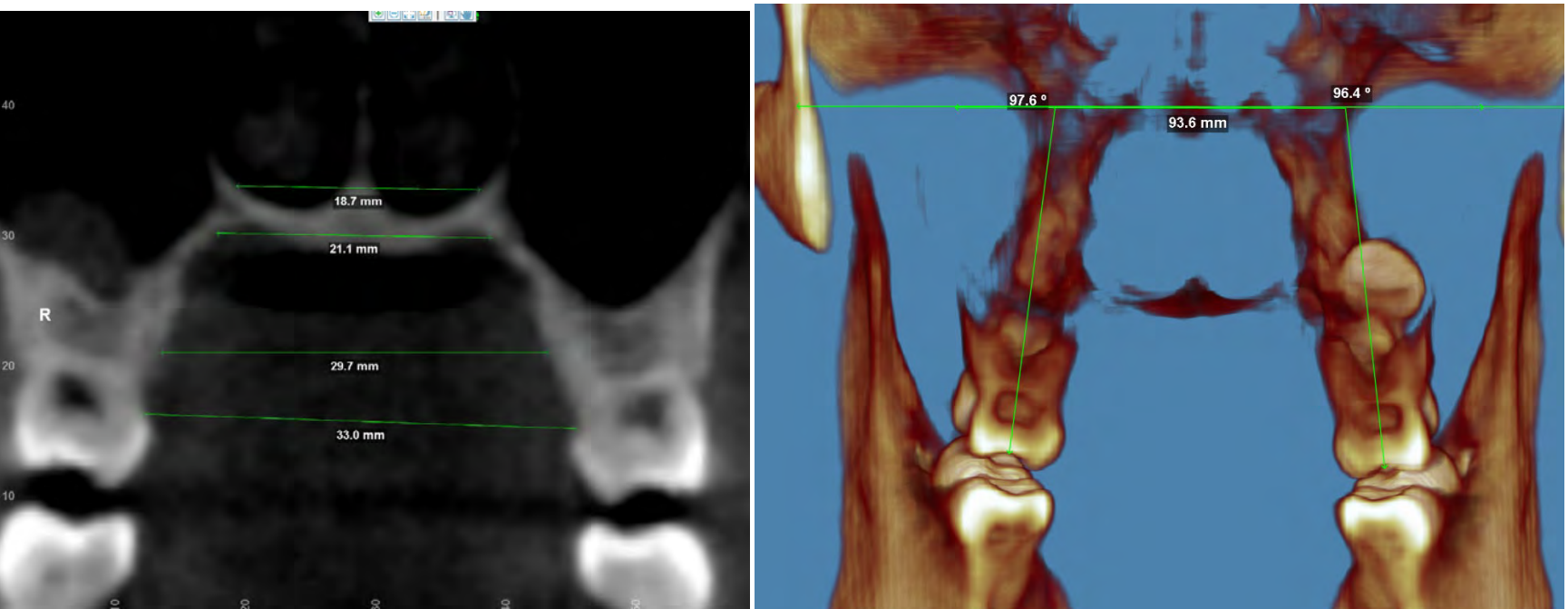


Fig. 4 – RPE patient. The image on the left shows the transversal measurements taken at different levels of the palate. On the right, the molar inclination measurement is shown. The measurements taken were: Transverse measurement at the upper right first molar trifurcation; Transverse measurement at the CEJ; Transverse measurement at the nasal floor and Transverse measurement at the palate:

## RESULTS AND DISCUSSION

The average age for RPE groups was 13.9±1.4, and 13.9±1.3 for the MARPE at T1. The t-test showed similar values in T1, such as IMPA (5.9°), ANB (1.6°), Lower Face Height (-3.7 mm), etc, when we compared RPE versus MARPE (Table 1).

Table 1- Independent t-test for the differences between groups in T1

	Independent Samples Test (RPE - MARPE)										
	p-value	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		p-value	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference		
				Lower	Upper				Lower	Upper	
FMA (MP-FH) (T1)	0.142	-2.3717	1.5837	-5.5677	0.8244	Lower Face Height (ANS-Gn) (mm) (T1)	0.027	-3.7650	1.6404	-7.0754	-0.4546
FMIA (LI-FH) (T1)	0.112	-3.5317	2.1749	-7.9208	0.8574	Interincisal Angle (U1-L1) (T1)	0.186	-5.1267	3.8158	-12.8273	2.5740
IMPA (LI-MP) (T1)	0.009	5.9075	2.1447	1.5793	10.2357	Vertical Face Height Ratio (%) (T1)	0.001	9.1133	2.5481	3.9711	14.2556
SNA (T1)	0.106	2.0758	1.2659	-0.4587	4.6103	Stm-1 (mm) (T1)	0.000	-2.6950	0.3852	-3.4724	-1.9176
SNB (T1)	0.741	0.3642	1.0939	-1.8434	2.5717	U1 - SN (T1)	0.573	1.1283	2.6527	-4.2250	6.4816
ANB (T1)	0.033	1.8967	0.7675	0.1478	3.2456	H-Angle (Pg*UL-Pg*Na') (T1)	0.000	5.8392	1.1680	3.4821	8.1963
FH - SN (T1)	0.533	0.4883	0.7770	-1.0797	2.0563	Anterior Face Height (NA*Me) (mm) (T1)	0.326	-2.1517	2.1656	-6.5221	2.2188
Occ Plane to SN (T1)	0.582	0.7967	1.4361	-2.1016	3.6949	Pog - NB (mm) (T1)	0.178	-0.7050	0.5121	-1.7385	0.3285
Wits Appraisal (mm) (T1)	0.238	1.3617	1.1363	-0.9315	3.6548	Mx Transverse UR6 furcation (mm) (T1)	0.001	2.2957	0.6271	1.0292	3.5621
U1 - NA (T1)	0.721	-0.9483	2.6332	-6.2624	4.3657	Nasal floor (T1)	0.027	1.4288	0.6202	0.1697	2.6880
U1 - NA (mm) (T1)	0.793	-0.2358	0.8922	-2.0364	1.5648	Palate (T1)	0.006	2.3841	0.8211	0.7172	4.0510
L1 - NB (T1)	0.035	4.3725	2.0041	0.3281	8.4169	CEJ-CEJ (T1)	0.010	2.5200	0.9266	0.6389	4.4011
L1 - NB (mm) (T1)	0.096	1.3167	0.7728	-0.2430	2.8763	UR6 (o) (T1)	0.902	-0.1900	1.5294	-3.2949	2.9149
Holdaway Ratio (%) (T1)	0.995	-0.0017	0.2525	-0.5112	0.5078	UL6 (T1)	0.422	1.4041	1.7290	-2.1059	4.9142
MP - SN (T1)	0.300	-1.8967	1.8080	-5.5453	1.7520	Tx Time	0.000	-14.944	3.376	-21.792	-8.097
Upper Lip to E-Plane (mm) (T1)	0.000	3.6142	0.7933	2.0132	5.2151	Age	0.330	-0.4250	0.4316	-1.2960	0.4460
Lower Lip to E-Plane (mm) (T1)	0.025	2.1675	0.9321	0.2864	4.0488						
Upper Face Height (N-ANS) (mm) (T1)	0.224	1.3067	1.0579	-0.8283	3.4416						

For the mandibular plane changes, there were no statistically significant values comparing T3-T1 in both groups. For the upper molar inclination, only the MARPE group showed a statistically significant difference between T3-T1 of 2.39° (right) and 3.30° (left). Transversally, both groups showed maxillary expansion in all variables (Table 2).

Table 2-Paired t-test for the mandibular plane differences and transversal measurement between T3 – T1 for each group.

	Paired Samples t-test					
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	p-value
<b>MARPE GROUP</b>						
FMA (MP-FH) (T1) - FMA (MP-FH) (T3)	-0.9056	2.4752	0.5834	-2.1364	0.3253	0.139
Mx Transverse UR6 furcation (mm) (T1) - Mx Transverse UR6 furcation (mm) (T3)	-4.9000	1.7186	0.4168	-5.7836	-4.0164	0.000
Nasal floor (T1) - Nasal floor (T3)	-3.7647	1.1597	0.2813	-4.3610	-3.1684	0.000
Palate (T1) - Palate (T3)	-4.0941	1.7683	0.4289	-5.0033	-3.1849	0.000
CEJ-CEJ (T1) - CEJ-CEJ (T3)	-4.1882	2.1977	0.5330	-5.3182	-3.0583	0.000
UR6 (o) (T1) - UR6 (o) (T3)	2.3941	3.5678	0.8653	0.5597	4.2285	0.014
UL6 (T1) - UL6 (o) (T3)	3.3000	3.6527	0.8859	1.4219	5.1781	0.002
<b>RPE GROUP</b>						
FMA (MP-FH) (T1) - FMA (MP-FH) (T3)	-0.0750	2.4994	0.5589	-1.2448	1.0948	0.895
Mx Transverse UR6 furcation (mm) (T1) - Mx Transverse UR6 furcation (mm) (T3)	-2.5800	1.6935	0.3787	-3.3726	-1.7874	0.000
Nasal floor (T1) - Nasal floor (T3)	-1.6950	0.7797	0.1743	-2.0599	-1.3301	0.000
Palate (T1) - Palate (T3)	-1.9050	1.4558	0.3255	-2.5864	-1.2236	0.000
CEJ-CEJ (T1) - CEJ-CEJ (T3)	-3.4500	2.8565	0.6387	-4.7869	-2.1131	0.000
UR6 (o) (T1) - UR6 (o) (T3)	-1.3000	4.7070	1.0525	-3.5029	0.9029	0.232
UL6 (T1) - UL6 (o) (T3)	-1.2200	5.8423	1.3064	-3.9543	1.5143	0.362

In addition, we found a statistically significant and negative moderate correlation (r=-0.663) with the mandibular plane angulation and right molar inclination (Table 3)

Table 3- Pearson correlation for the MARPE group showed a statistical moderate correlation with the molar inclination at T3 and mandibular plane

		MPSNT3T1
HAnglePgLpPgNaT3T1	Pearson Correlation	-0.277
	Sig. (2-tailed)	0.282
	N	17
AnteriorFaceHeightNaMemT3T1	Pearson Correlation	.729*
	Sig. (2-tailed)	0.001
	N	17
PogNBmmT3T1	Pearson Correlation	-0.023
	Sig. (2-tailed)	0.931
	N	17
MxTransverseUR6furcationmmT3T1	Pearson Correlation	-0.014
	Sig. (2-tailed)	0.958
	N	17
NasalfloorT3T1	Pearson Correlation	-0.144
	Sig. (2-tailed)	0.582
	N	17
PalateT3T1	Pearson Correlation	0.003
	Sig. (2-tailed)	0.991
	N	17
CEJCEJT3T1	Pearson Correlation	-0.256
	Sig. (2-tailed)	0.321
	N	17
UR6oT3T1	Pearson Correlation	-.663*
	Sig. (2-tailed)	0.004
	N	17

## CONCLUSION

This study showed that there are no statistically significant differences between and after treatment for the mandibular angle changes comparing both groups; however, a moderate negative correlation was found with the molar inclination and the mandibular plane angle in the MARPE group.

## REFERENCES

1. Melsen, B. & Melsen, F. The postnatal development of the palatomaxillary region studied on human autopsy material. Am. J. Orthod. 82, 329-342 (1982).
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3. Oh, H., Park, J. & Lagravere-Vich, M. O. Comparison of traditional RPE with two types of micro-implant assisted RPE: CBCT study, in Seminars in Orthodontics vol. 25 60-68 (Elsevier, 2019).

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### OKU Sutro Excellence Day Project Cover Sheet

(ONE Cover Sheet per project)

Assessment of mandibular plane changes using conventional versus miniscrew-assisted rapid palatal expansion in adolescents

Project Title: \_\_\_\_\_

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List names of all contributors to this project:

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**Objectives:** The objective of this study was to assess the cephalometric and transversal changes in growing patients (adolescents) using two different types of maxilla expanders: conventional rapid palatal expander (RPE) and miniscrew-assisted rapid palatal expander (MARPE). Our hypothesis is that there are no significant differences between the two groups for the molar inclination, maxilla expansion amount, and mandibular plane changes. **Materials and Methods:** This was a retrospective study using CBCT scans. After IRB approval, we collected the scans of 17 MARPE and 20 RPE patients at two different time points: initial treatment (T1) and final (T3). The Dolphin® software was used to orient the skulls and trace the lateral cephalograms and assess the maxillary transversal and upper molar changes. A total of 32 measurements were analyzed. **Results:** The average age for RPE groups was  $13.9 \pm 1.4$ , and  $13.9 \pm 1.3$  for the MARPE at T1. The t-test showed similar values in T1, including IMPA ( $5.9^\circ$ ), ANB ( $1.6^\circ$ ), Lower Face Height ( $-3.7$  mm), etc., when we compared RPE versus MARPE. For the mandibular plane changes, there were no statistically significant values comparing T3-T1 in both groups. For the upper molar inclination, only the MARPE group showed a statistically significant difference between T3-T1 of  $2.39^\circ$  (right) and  $3.30^\circ$  (left). Transversally, both groups showed maxillary expansion. In addition, we found a statistically significant and negative moderate correlation ( $r = -0.663$ ) with the mandibular plane angulation and right molar inclination. **Conclusion:** This study showed that there are no statistically significant differences between and after treatment for the mandibular angle changes comparing both groups; however, a moderate correlation was found with the molar inclination and mandibular plane angle in the MARPE group. **Acknowledgment:** This study was partially funded by the Research Enhancement Award Activity 141 from the University of the Pacific, Arthur A. Dugoni School of Dentistry.

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