

Effects of maximal and minimal mouth opening on mandibular flexure with digital scanning

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What is mandibular flexure?

Mandibular flexure is a complex mandibular deformation process that changes the shape and decreases the width of the mandibular arch

Why is it important?

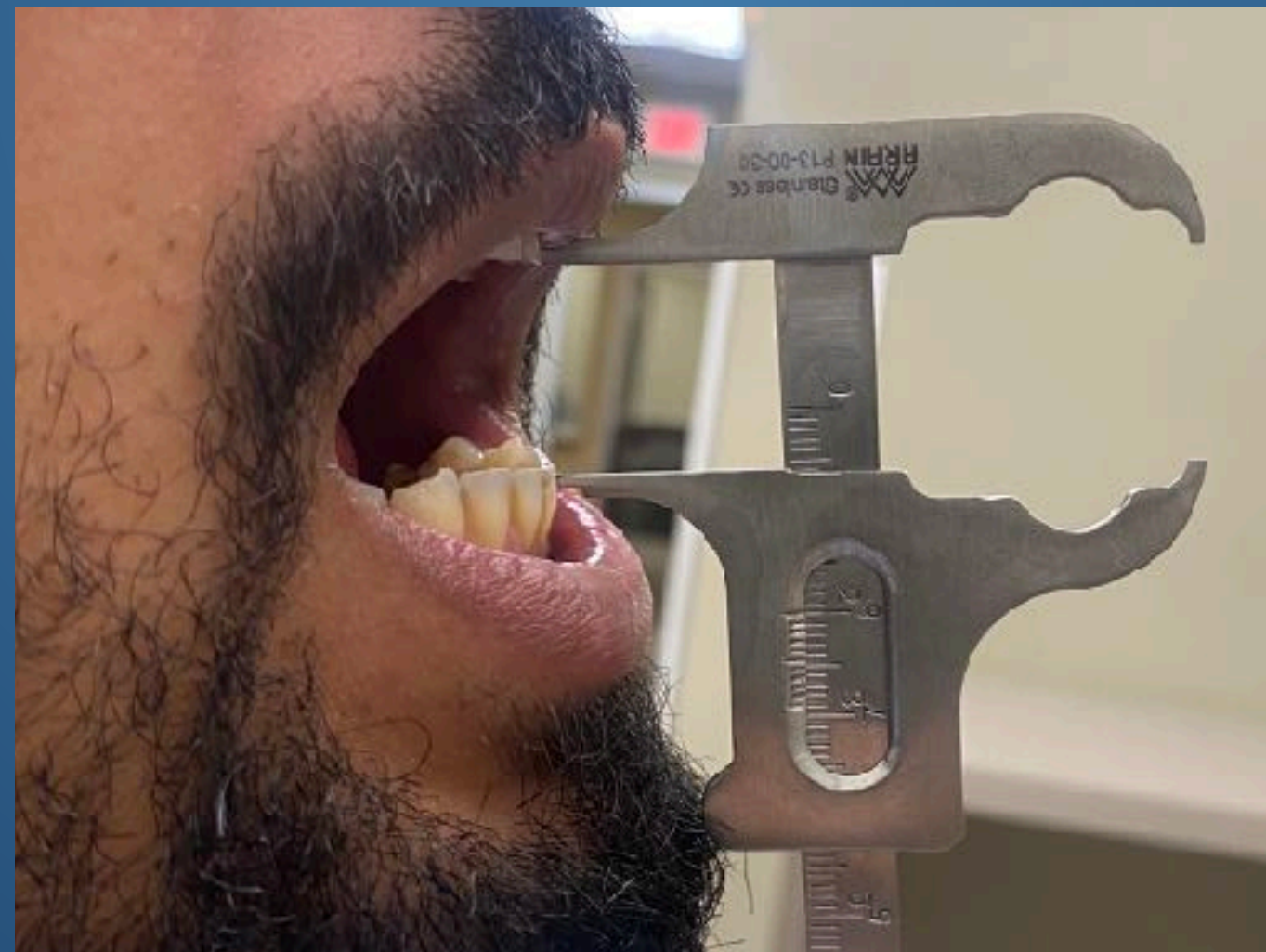
Periodontal Considerations	Mandibular flexure results in further alveolar bone loss
Prosthodontic Considerations	The dorsoventral shear mismatch between the superstructure and jaw creates a separating force that breaks the cement seal
Consideration for Implants	Bone loss around implants, Loss of implant fixation, Material fracture, Discomfort on mouth opening

Materials & Methods

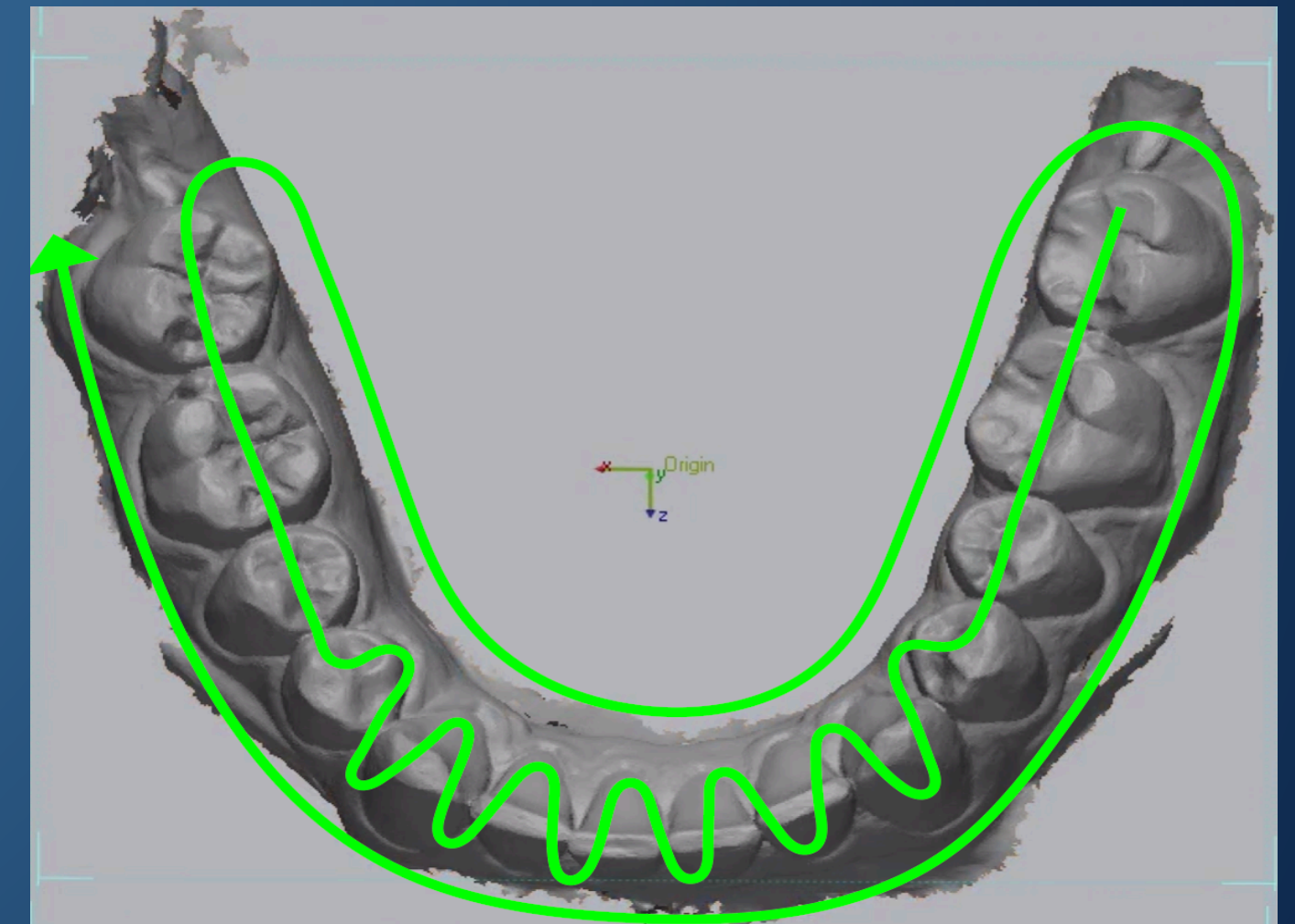
This study examined 70 dental students (35 males, 35 females) aged 26–35, using digital impressions to capture mandibular flexure at maximum (≥ 50 mm) and minimal (20 mm) mouth openings. Two digital impressions were made for each study participant: one with mouth opened as wide as possible (≥ 50 mm), and a second recording with the minimal mouth opening (20 mm). A straight scanning motion was used in the posterior area of the mandible. The scanning strategy began at the occlusal surfaces of the mandibular left second molar, progress across the arch to the palatal side, and then continuously returned along the buccal side. Zigzag motions were employed in the anterior region. For the minimum mouth opening of 20 mm, only buccal and occlusal surfaces were obtained as the scanner's size prevented it from scanning the lingual side.



Maximum Mouth Opening(≥ 50 mm)



Minimum Mouth Opening(20 mm)



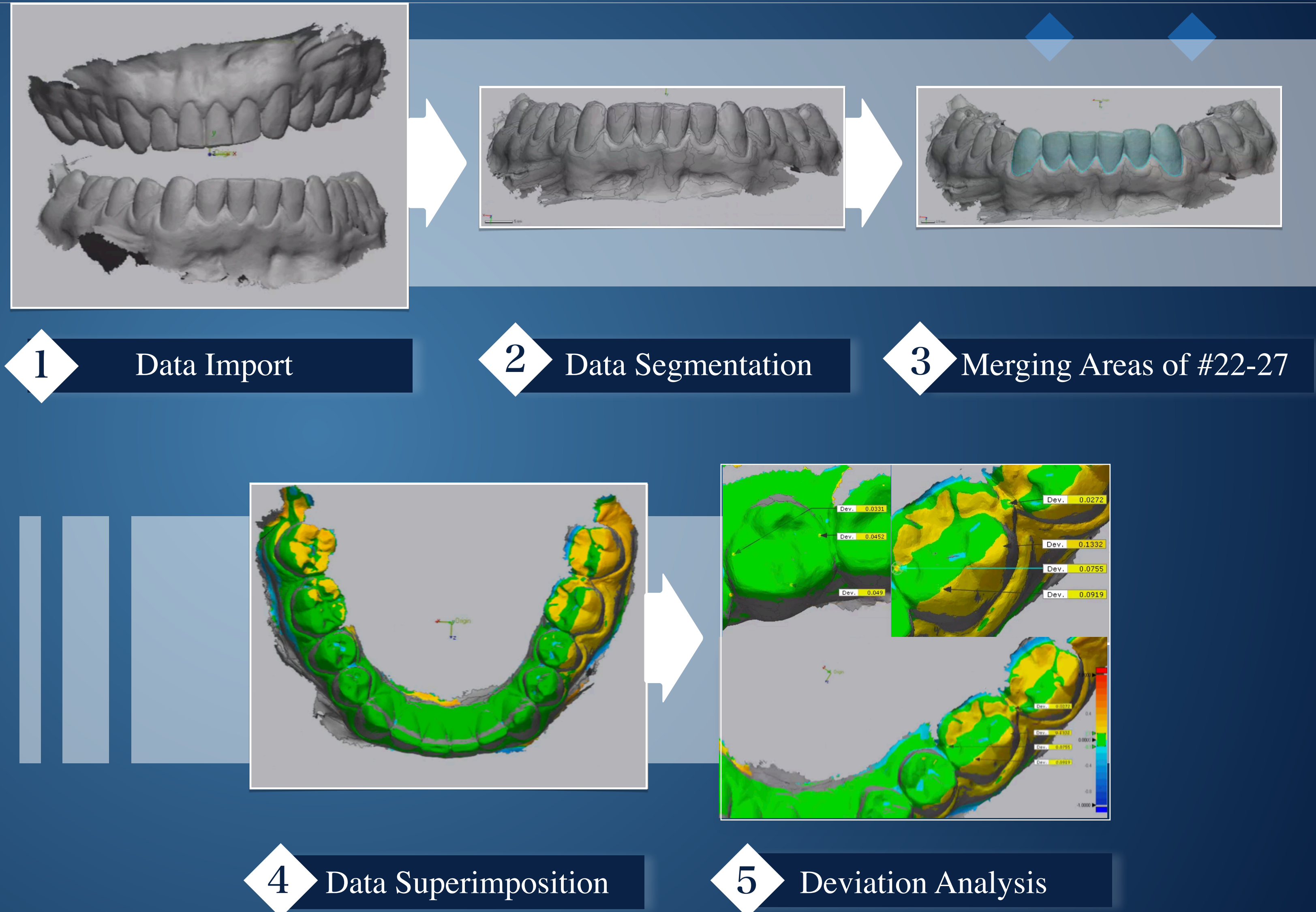
The Scanning Strategy

After digitizing all patients, virtual models were constructed using three-dimensional analysis software.

The minimal mouth opening scan was set as the reference model, and the maximal mouth opening scan was superimposed onto it. To ensure accurate alignment, only the 22–27 region was used, as it exhibits minimal deviations.

An initial alignment was followed by a best-fit alignment.

Deviations were then measured at specific points on molars and premolars, averaged within each tooth type, and used as representative values for analysis.



Results

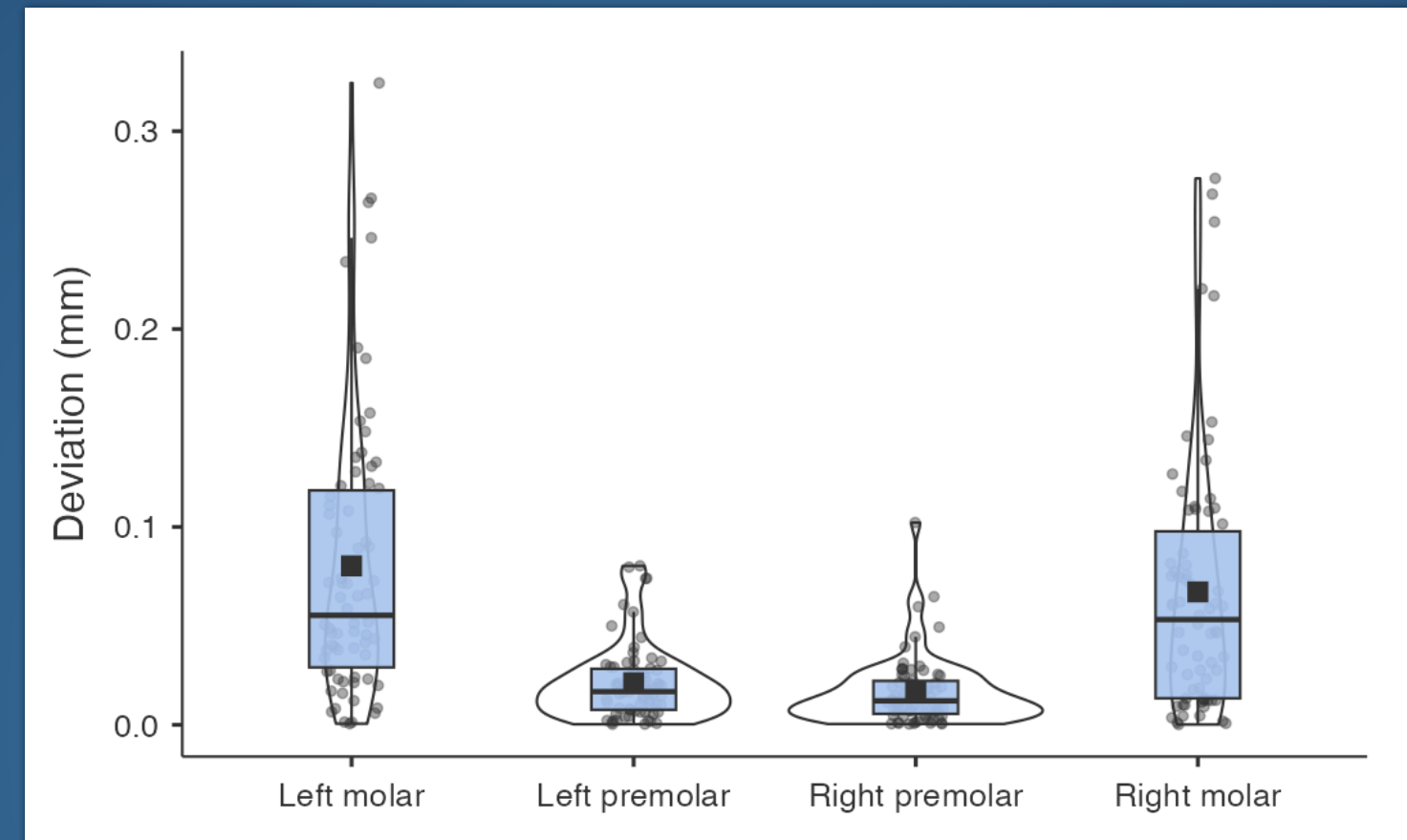
First molars exhibited greater deviations than premolars in both linear and rotational measurements at maximum mouth opening.

Repeated measures ANOVA confirmed a statistically significant difference between minimal and maximal mouth opening, with greater deviations occurring at maximal opening.

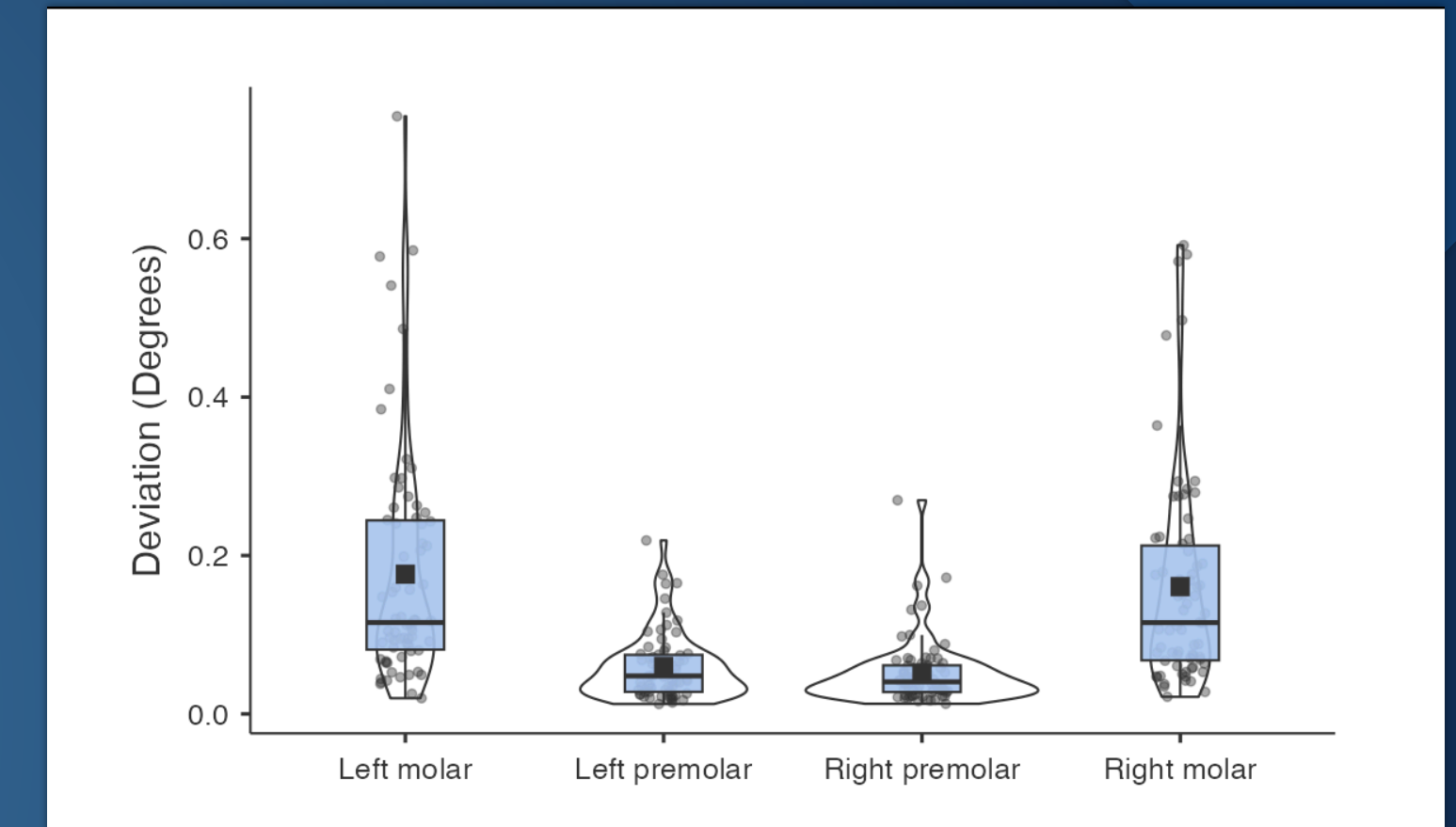
While female subjects showed larger deviations than males in both linear and rotational measurements, the Independent Samples T-test indicated no statistically significant difference. Mean deviations for molars were consistently higher than those for premolars in both linear and rotational measurements.

Figure

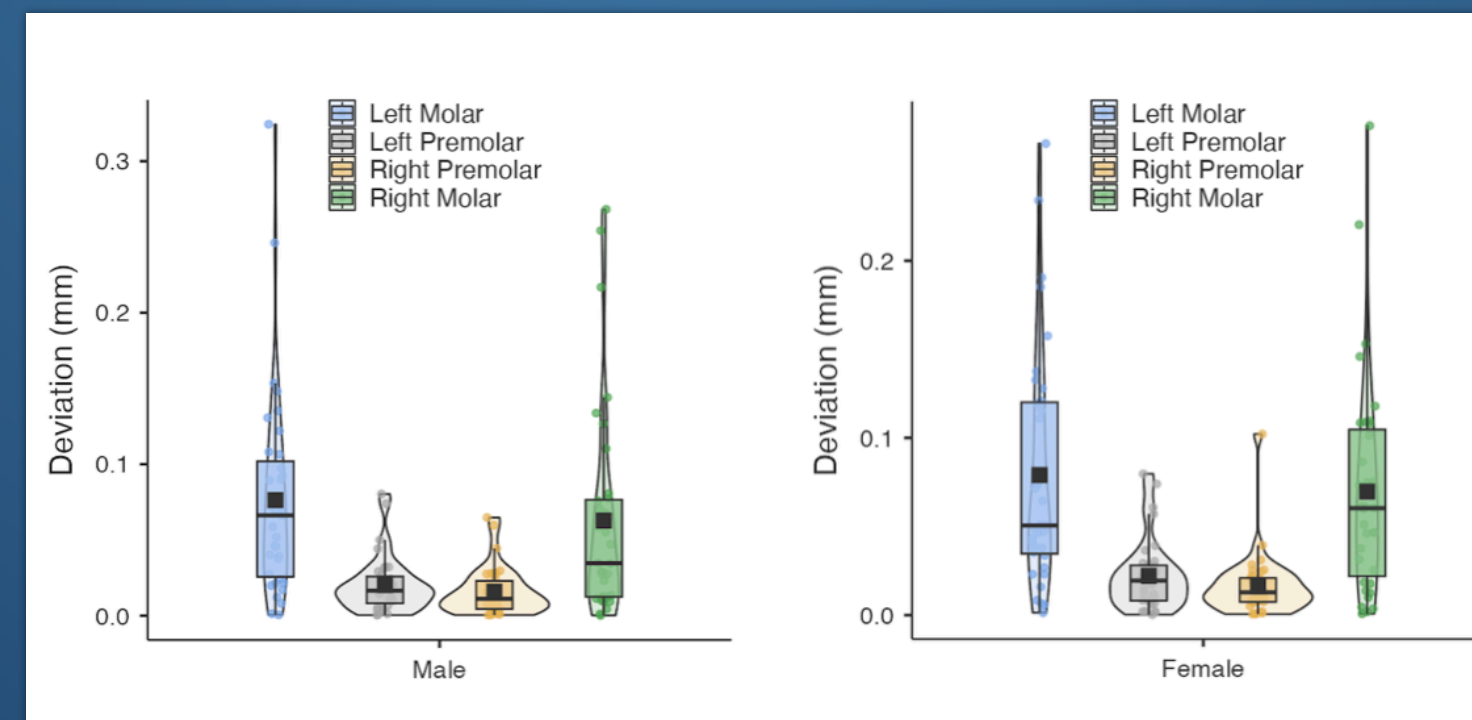
5 Linear deviation for each tooth



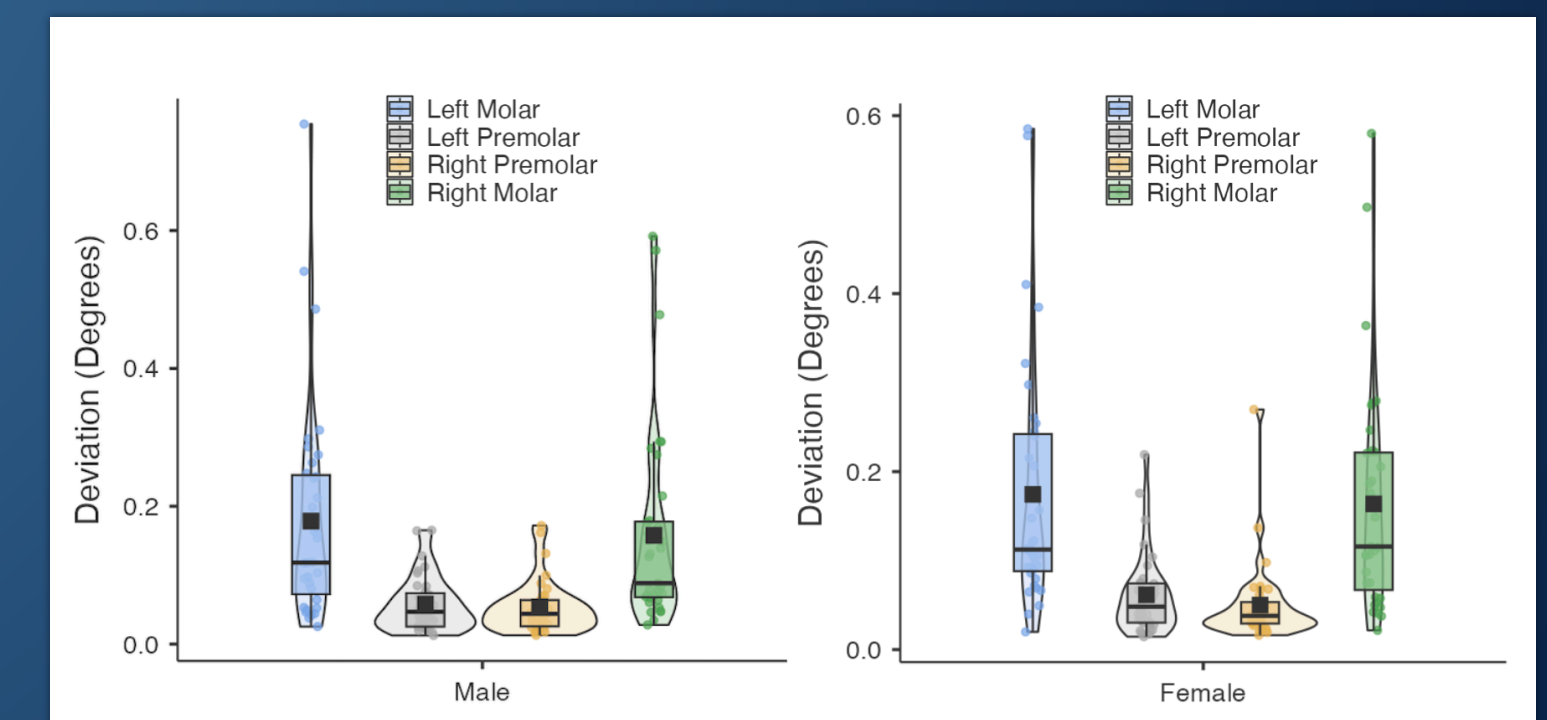
6 Rotational deviation for each tooth



7 Linear deviation differences between male and female subjects



8 Rotational deviation differences between Male subjects and female subjects



Table

1 The difference in linear and rotational deviation between molars and premolars

	Mean ± Sd		P-value
	1st Molars (N=140)	1st Premolars (N=140)	
Linear Deviation (mm)	0.074 ± 0.068	0.019 ± 0.018	<.001
Rotational Deviation (°)	0.170 ± 0.142	0.056 ± 0.042	<.001

2 The disparity in linear deviation between males and females

	Mean ± Sd		
	Linear Deviation (mm)		
	Male (N=35)	Female (N=35)	P-value
Left 1st Molar	0.076 ± 0.068	0.079 ± 0.067	0.868
Left 1st Premolar	0.020 ± 0.019	0.022 ± 0.020	0.682
Right 1st Premolar	0.016 ± 0.016	0.016 ± 0.018	0.903
Right 1st Molar	0.063 ± 0.069	0.070 ± 0.061	0.656

3 The disparity in rotational deviation between males and females

	Mean ± Sd		
	Rotational Deviation (°)		
	Male (N=35)	Female (N=35)	
Left 1st Molar	0.179 ± 0.159	0.174 ± 0.141	0.909
Left 1st Premolar	0.058 ± 0.400	0.062 ± 0.456	0.733
Right 1st Premolar	0.054 ± 0.384	0.050 ± 0.454	0.705
Right 1st Molar	0.158 ± 0.144	0.164 ± 0.127	0.855

4 The linear and rotational mean deviation for 1st molars

	Mean ± Sd	
	1st Molars	
	Left 1st Molar (N=70)	Right 1st Molar (N=70)
Linear Deviation	0.080 ± 0.070	0.067 ± 0.065
Rotaional Deviation	0.176 ± 0.149	0.161 ± 0.135

5 The linear and rotational mean deviation for 1st premolars

	Mean ± Sd	
	1st Premolars	
	Left 1st Premolar (N=70)	Right 1st Premolar (N=70)
Linear Deviation	0.021 ± 0.019	0.017 ± 0.017
Rotaional Deviation	0.060 ± 0.043	0.052 ± 0.042

Conclusion

First molars showed greater linear and rotational deviations than first premolars, with significantly larger deviations at maximal mouth opening. Female subjects exhibited larger mean deviations than males, but the differences were not statistically significant. The study's findings were smaller in magnitude compared to previous research. These results suggest that mandibular flexure causes fewer problems than previously assumed; however, further studies are needed to validate these findings.