

# Evaluation of Skeletal and Dental Asymmetries in Patients with Angle Class II Subdivision Malocclusion with 3-Dimensional Analysis of Cone-Beam Computed Tomography

SEONGHYEON (KURT) KIM, ALYSSA MORROW, KYRA LEE, HEEYEON SUH, IVAN LO, JOOROK PARK, HEESOO OH

Department of Orthodontics, University of the Pacific, Arthur A. Dugoni School of Dentistry, San Francisco

## INTRODUCTION

- Dentofacial asymmetries can present substantial challenges to orthodontic treatment.<sup>1</sup> They, which can be congenital, developmental, and acquired, are based on discrepancies in the two halves of the face with reference to size, form, and arrangement of facial landmarks.
- Class II subdivision malocclusions show more than half-step Class II occlusion on one side of the dental arch and Class I molar occlusion on the other side of the dental arch. They attribute to 50% of all Class II malocclusions and are one of the most frequent dental asymmetries in the orthodontic population.<sup>2</sup>
- Cone-beam computed tomography (CBCT) can be used to examine skeletal and dental asymmetries in Class II subdivision malocclusions and other morphological features of the craniofacial structures of facial asymmetry.<sup>3</sup>



- Mandibular asymmetry (skeletal) was the primary factor that contributed to Angle Class II subdivision malocclusions. Class II side had shorter total mandibular length and ramus height and deviated mandibular dental midline landmarks (pogonion and menton). Mandibular dental landmarks were positioned more latero-posterio-superiorly.<sup>4</sup>

## OBJECTIVE

- To evaluate whether subjects with Angle Class II subdivision malocclusions have a significant skeletal contribution to the asymmetric malocclusion utilizing 3-dimensional analysis with cone-beam computed tomography (CBCT).

## MATERIALS & METHODS

### Design

- Retrospective study; records collected from University of the Pacific, Arthur A. Dugoni School of Dentistry Graduate Orthodontic Clinic

### Inclusion Criteria

- Have complete initial records and photographs
- Have intraoral scans with occluded models
- Have initial full-volume CBCT
- Have all permanent dentition
- Have at least 3mm of Class II molar relationship on one side and Class I molar on the other side
- Have all premolars and molars present

### Exclusion Criteria

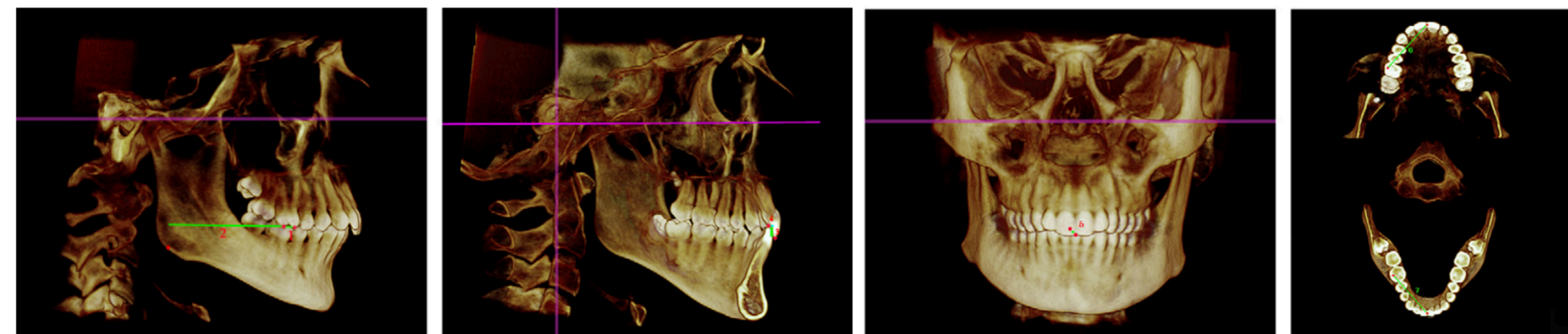
- Have syndromes or history of cleft lip or palate
- History of prior orthodontic care
- Impacted canines

### Sample

- 108 subjects
  - 61 females and 47 males
  - Age range between 10-63 years; Average: 21 years
  - Class II side: 54 Lt (50%) and 54 Rt (50%)

### Method

- Two calibrated judges located 33 landmarks and generated a 3D analysis for each patient using Anatomage InVivo6<sup>®</sup> 3D imaging software.



### Statistics

- Paired t-test was used to determine if there are significant differences between Class I and Class II skeletal and dental measurements for all subjects (N=108) and for only those with skeletal asymmetry (Me deviation >2mm to Class II side: Asymmetry group, N =34).
- Pearson correlation/linear regression analyzed degrees of skeletal asymmetry and Class II malocclusion for proportionality.

## RESULTS

- Midline landmarks, Menton and Pogonion, had similar distribution while ANS showed less deviation. (Figure 1)

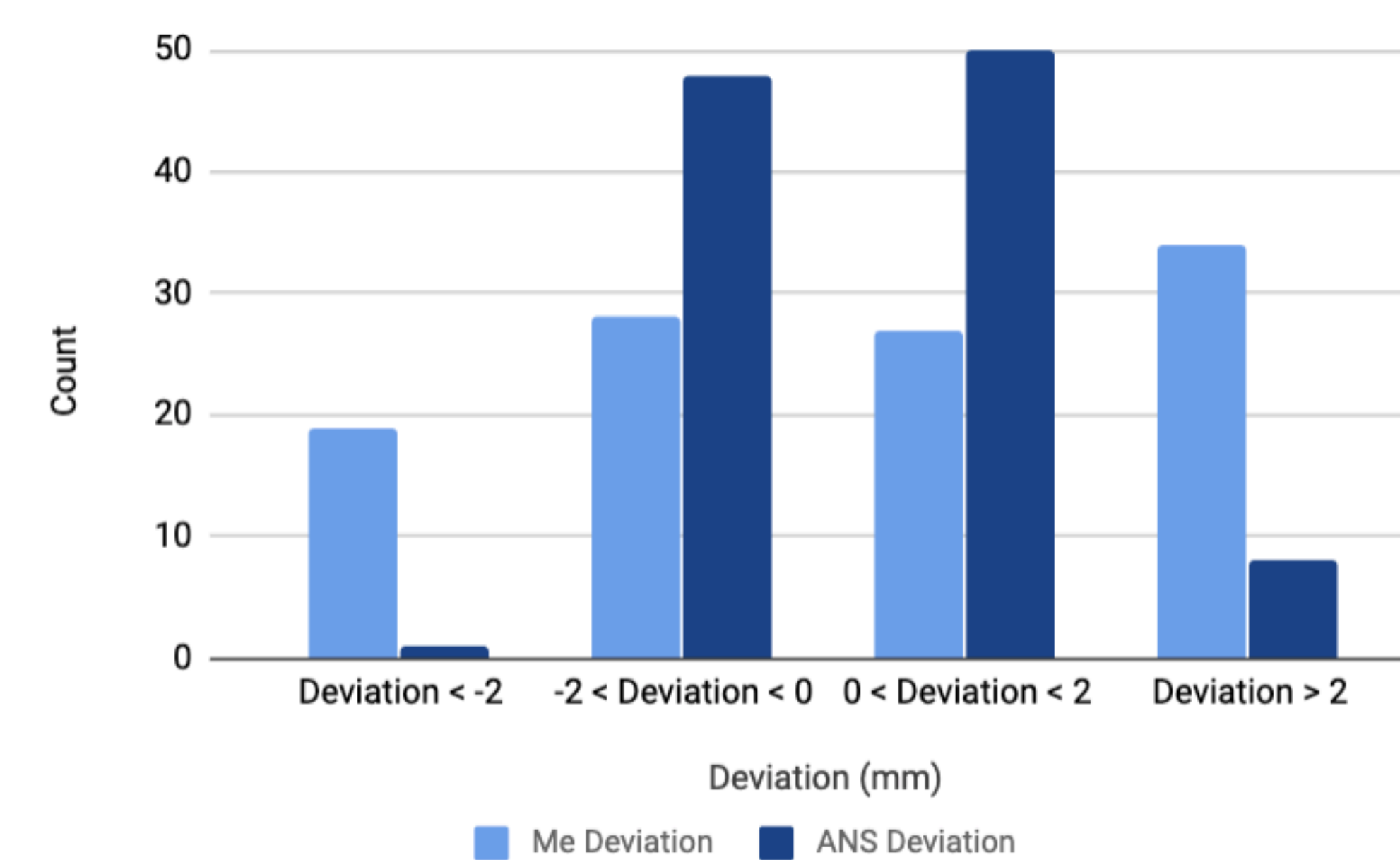


Figure 1. Distribution of Menton and ANS Deviations (+ = to the Class II side; - = to the Class I side)

- In the skeletal asymmetry group, Class II side had shorter Ramus and Mandibular total lengths.

Asymmetry group (N=34)	Class I side		Class II side		Class I - Class II side		paired t-test
	Mean	SD	Mean	SD	Mean	SD	
Mn Body Length	75.59	4.12	75.31	3.80	0.28	1.93	NS
Ramus length	64.24	6.10	61.26	5.49	2.98	3.33	<.0001
Mn Total Length	120.03	6.59	117.00	6.10	3.03	2.53	<.0001
Gonion Angle	121.42	6.61	121.73	6.69	-0.30	4.31	NS
U6.to.S.perp	42.75	5.58	43.93	5.88	-1.17	1.45	<.0001
L6.to.S.perp	44.37	5.47	42.35	6.14	2.01	2.06	<.0001

- There was a positive correlation ( $r=0.37$ ,  $p=0.03$ ) between mandibular body length difference and degree of Class II malocclusion (U6-L6 AP diff). When the mandibular body length is shorter on the Class II side, molars presented more Class II. (Figure 2)

Asymmetry group (N=34)	U6-L6 AP diff on Class II side	
	Correlation coefficient	p-value
ANS to MSP	-0.18	NS
Menton to MSP	-0.04	NS
Ramus length	-0.11	NS
Mn body length	0.37	0.03
Mn total length	0.13	NS
U6.to.S.perp	-0.07	NS
L6.to.S.perp	0.65	<0.0001

- There was a positive correlation ( $r=0.65$ ,  $p<.0001$ ) between L6 anterior-posterior position difference of the Class I and Class II sides and the degree of Class II malocclusion. The more anterior L6 on Class I side or the more posterior L6 on the Class II side, the greater degree of Class II malocclusion. (Figure 3)

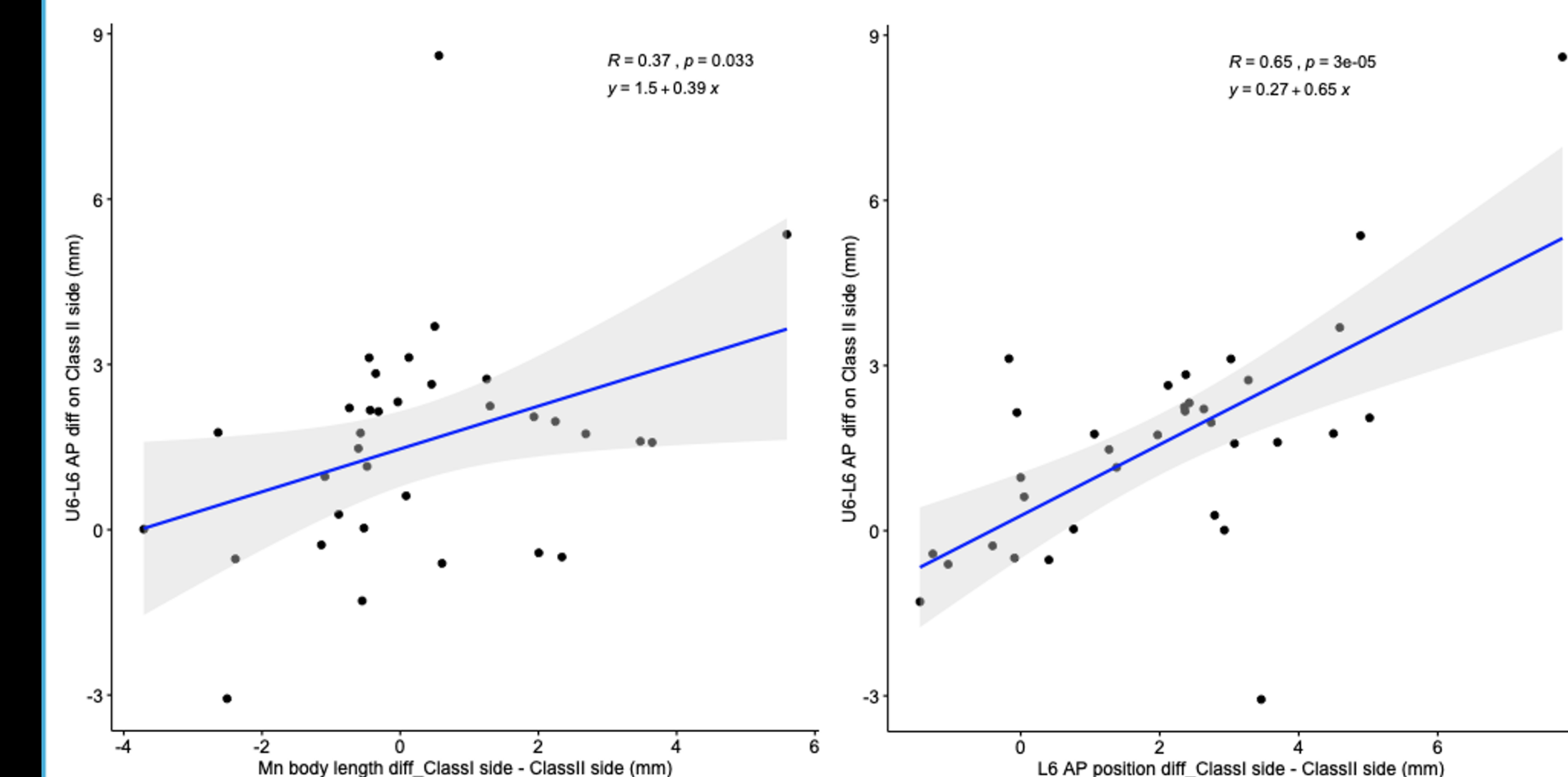


Figure 2

Figure 3

## CONCLUSION

- 31.5% of subjects showed significant skeletal asymmetry defined as Me deviation > 2mm to Class II side.
- There was no significant difference in skeletal size between Class I and Class II sides for the whole cohort (N = 108). However, there was a significant difference in total mandibular length between Class I and Class II sides in the asymmetry group (N = 34). This appeared to result from shorter ramus length on the Class II side.
- Degree of Class II malocclusion did not show a strong correlation to skeletal asymmetry and was most affected by dental L6 AP position. However, it did show a statistically significant weak positive correlation with mandibular body length difference between Class I and Class II sides.

## REFERENCES

- Sanders, Derek A, et al. "Quantification of Skeletal Asymmetries in Normal Adolescents: Cone-Beam Computed Tomography Analysis." *Progress in Orthodontics*, vol. 15, no. 1, 2014.
- Sheats, Rose D., et al. "Prevalence of Orthodontic Asymmetries." *Seminars in Orthodontics*, vol. 4, no. 3, 1998, pp. 138-145.
- Kwon, T.-G., et al. "A Comparison of Craniofacial Morphology in Patients with and without Facial Asymmetry—a Three-Dimensional Analysis with Computed Tomography." *International Journal of Oral and Maxillofacial Surgery*, vol. 35, no. 1, 2006, pp. 43-48.
- Sanders, Derek A., et al. "Skeletal and Dental Asymmetries in Class II Subdivision Malocclusions Using Cone-Beam Computed Tomography." *American Journal of Orthodontics and Dentofacial Orthopedics*, vol. 138, no. 5, 2010.