Vertical Dimensions of Mandible in Class II Subdivision Malocclusion with Skeletal Asymmetry

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INTRODUCTION

- Advancements in 3-dimensional imaging analysis, utilizing cone-beam computed tomography (CBCT), have allowed for further investigation of skeletal asymmetry.
- While past 2-dimensional studies attributed dentoalveolar deviation to unilateral Class II malocclusion, recent 3D studies have found a primarily skeletal contribution.[1]
- There is much debate on the impact of condylar morphology on malocclusion in patients with Class II subdivision and significant skeletal asymmetry.[2]
- Some authors concluded that condylar characteristics are not correlated with skeletal asymmetry, while others reported a correlation between a greater condyle angulation and skeletal asymmetry.[2-4]

OBJECTIVE

- To investigate whether asymmetrical vertical linear and angular dimensions of condyles and mandible contribute to skeletal asymmetry in patients with Class II subdivision utilizing 3-dimensional images.

METHODS

DESIGN
- Retrospective Study
- Records collected from University of the Pacific, Arthur A. Dugoni School of Dentistry Graduate Orthodontic Clinic

INCLUSION CRITERIA
- Have complete set of initial records and photographs
- Have intraoral scans with occluded models
- Have initial full-volume CBCT
- Have all permanent dentition (no primary teeth)
- Have at least 3mm of Class II molar relationship on one side and Class I molar on the other side
- Have at least 2mm Me deviation on Class II 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
- 34 subjects
  - 17 females (50%) and 17 males (50%)
  - Age range between 10-47 years; Average: 18.8
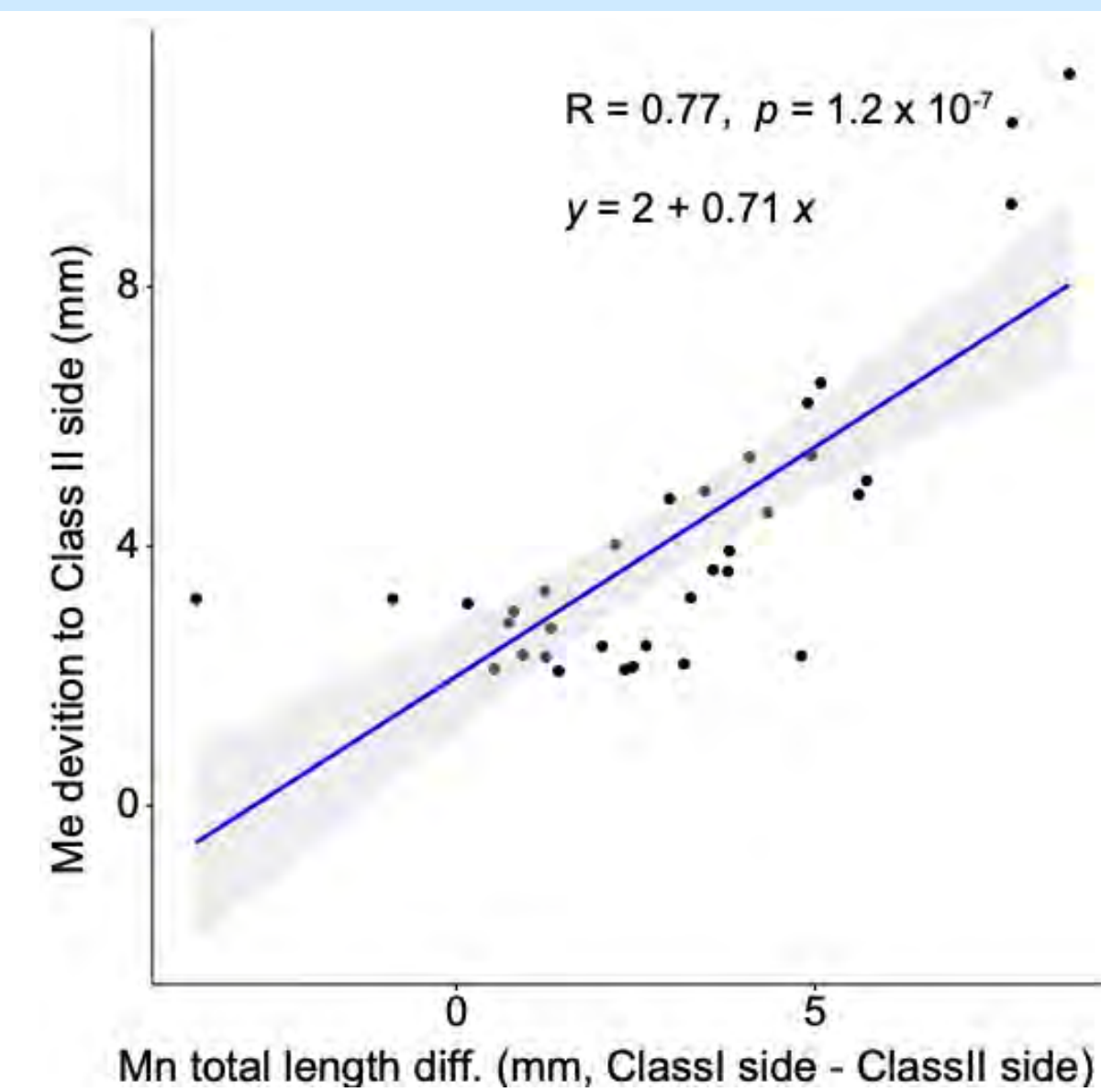 - Class II side: 23 Lt (68%) and 11 Rt (32%)

METHODS

- 4 calibrated judges (DDS students) independently located 29 landmarks and generated 3-dimensional analysis using Anatomage InVivo 3D Imaging Software
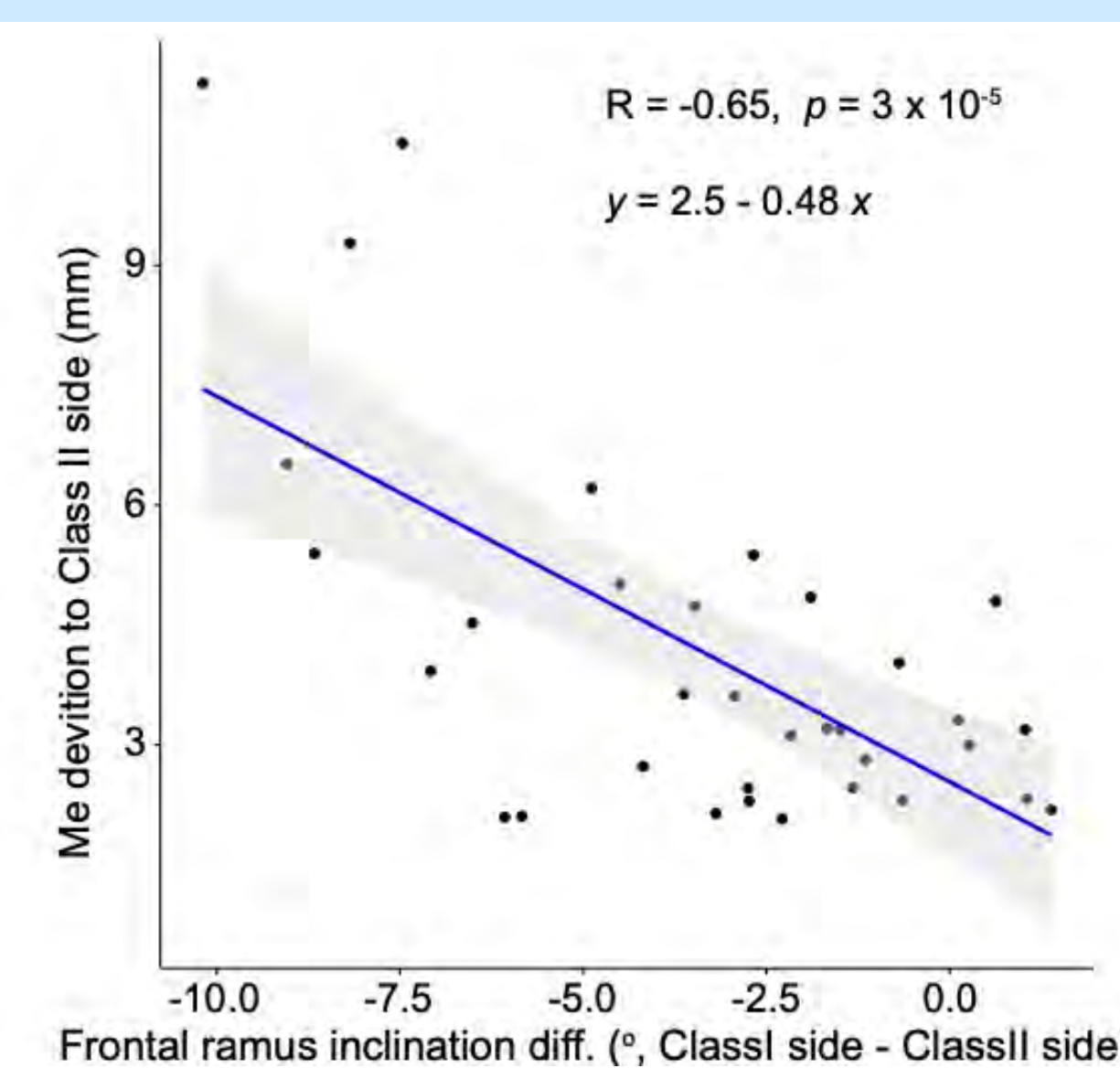
STATISTICS
- A paired t-test was used to evaluate vertical differences between Class II and I sides (Table 1)
- A Pearson correlation and linear regression was used to evaluate the relationship between skeletal asymmetry (transverse deviation) and condylar (vertical, angular) asymmetry (Table 2)
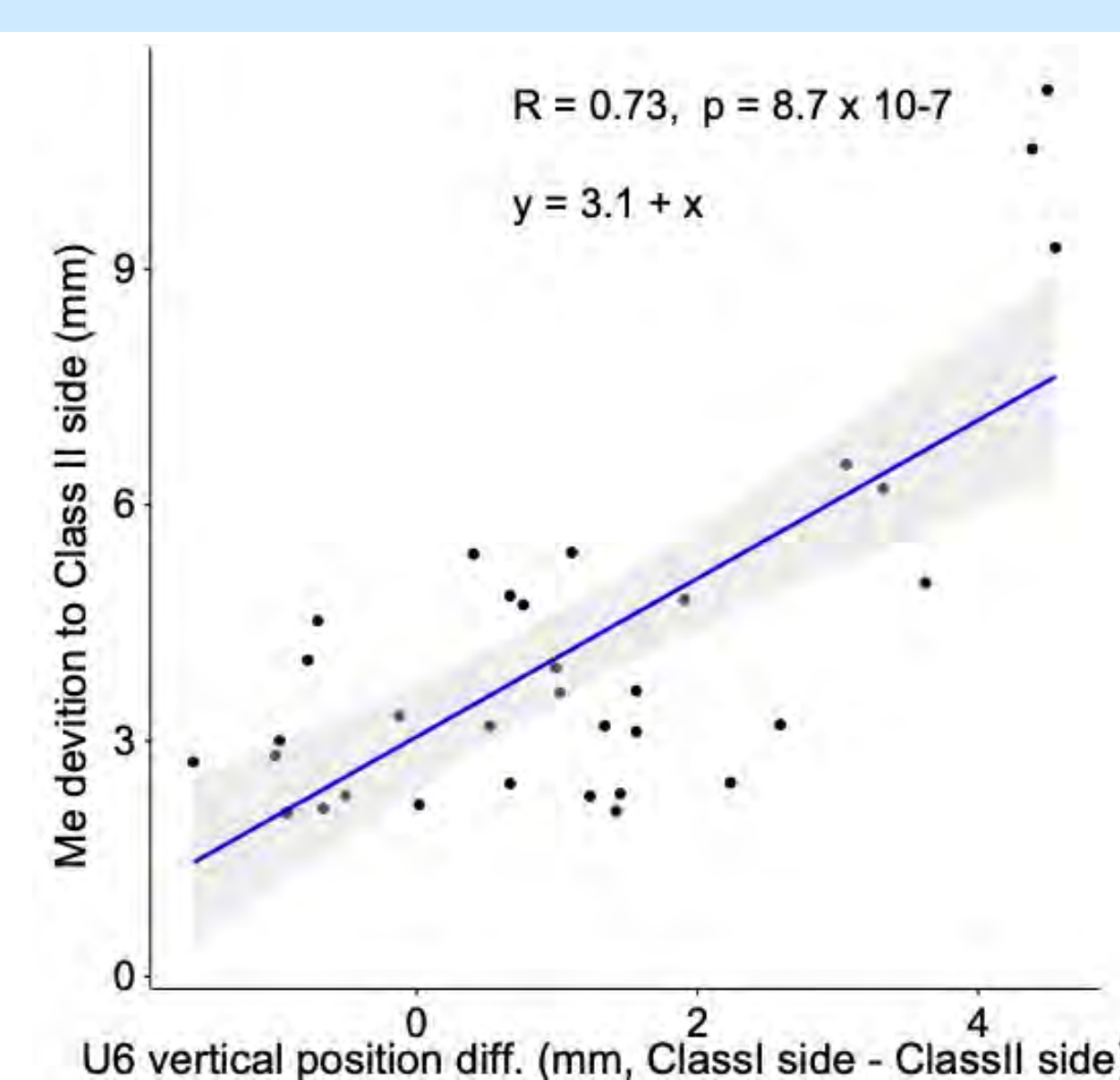
FIGURE 1

R = 0.77, p = 1.2 x 10^-7

y = 2 + 0.71 x

FIGURE 2

R = -0.65, p = 3 x 10^-5

y = 2.5 - 0.48 x

FIGURE 3

R = 0.73, p = 8.7 x 10^-7

y = 3.1 + x

TABLE 1

Vertical (Maxillary and Dental) Differences Between Class I and II Sides

	Class I side		Class II side		Class I - Class II side		paired t-test
	mean	sd	mean	sd	mean	sd	p-value
Ramus length	64.24	6.10	61.26	5.49	2.98	3.33	<0.0001
Condyle Vertical Position	18.87	3.20	19.26	3.08	-0.39	1.24	NS
Gonion Vertical Position	81.64	7.60	79.46	7.07	2.19	2.96	<0.0001
Condylar Height	17.30	2.40	16.07	2.26	1.23	1.88	0.0006
Frontal Ramus Inclination	74.87	3.74	78.19	3.73	-3.32	3.15	<0.0001
Lateral Ramus Inclination	75.75	3.81	76.57	4.08	-0.82	1.96	0.02
Mx height	37.48	4.31	36.62	4.22	0.87	1.49	0.002
U6 Vertical Position	64.45	5.48	63.37	4.91	1.08	1.70	0.0008

TABLE 2

Correlation Between Skeletal Asymmetry (Transverse Deviation) and Condylar (Vertical, Angular) Asymmetry

	Me to Midsagittal plane	
	Correlation Coeff *	p-value
ANS to MSP	0.30	NS
Ramus Length	0.59	0.0002
Mn Total length	0.77	<0.0001
Condyle Vertical Position	0.05	NS
Gonion Vertical Position	0.60	0.0002
Condylar Height	0.43	0.012
Frontal Ramus Inclination	-0.65	<0.0001
Lateral Ramus Inclination	-0.06	NS
Gonion Angle	-0.33	NS
Mx height	0.10	NS
U6 Vertical Position	0.73	<0.0001

* Menton to Midsagittal plane:
(+) = Shorter or more superiorly positioned on the Cl II side, greater the Me deviation to the Class II side;
(-) = Smaller the angle on the Cl II side, lesser the Me deviation to the Class II side

RESULTS

- A significant skeletal and dental vertical differences between Class I and II sides was found for all measurements except Condyle vertical position (Table 1).

- Of which, Class II side had shorter Ramus length, Condylar height, Maxilla height; superior vertical positions of Gonion and U6; larger Frontal and Lateral ramus inclination than Class I side (Table 1, Figure 4).

- Vertical measurements and the amount of skeletal asymmetry showed a positive correlation for Ramus length (0.59, p=0.0002), Gonion vertical position (0.60, p=0.0002), and Condylar height (0.43, p=0.012) (Figure 1, Table 2).

- A negative correlation was found for Frontal ramus inclination (-0.65, p<0.0001) (Figure 2, Table 2)

- A positive correlation was found for U6 vertical position (0.73, p<0.0001) (Figure 3, Table 2).

CONCLUSION

- The results suggest there are skeletal (condylar, vertical, and angular) differences between Class I and Class II sides in patients with skeletal asymmetry.

- Furthermore, some of these skeletal (vertical and angular) differences may be correlated with the amount of skeletal asymmetry (Me deviation).

- Of which, more Me deviation to Class II side was found for Class II side with decreased Ramus length, Condylar height, superior vertical position of Gonion and U6, and increased Frontal ramus inclination than Class I side.

CLINICAL RELEVANCE

- CBCT imaging may offer high diagnostic value when treating class II subdivision patients with significant skeletal asymmetry as they may be at a higher risk of experiencing significant vertical and angular skeletal differences between Class I and II sides as well as occlusal canting.
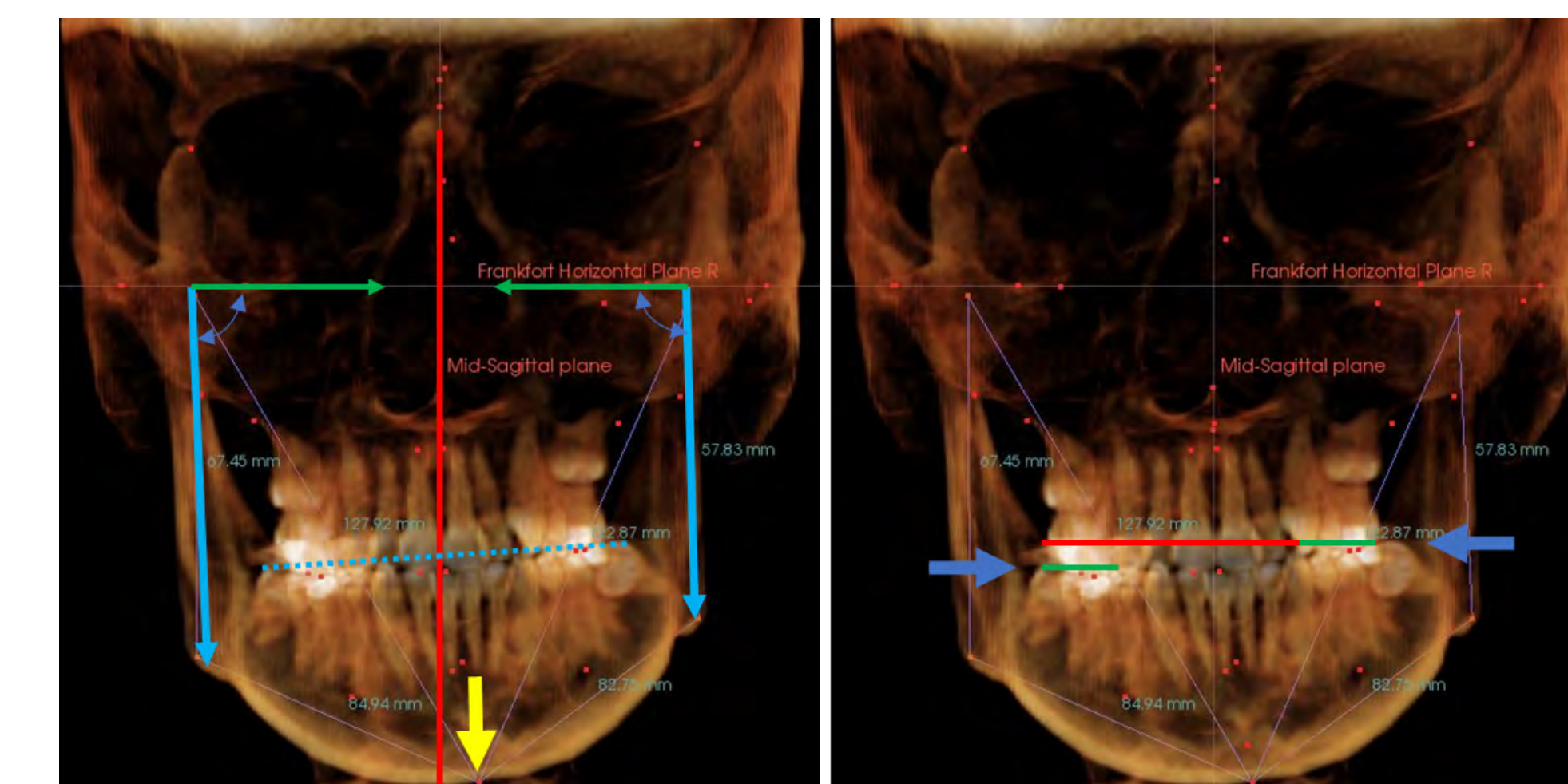

Figure 4. Me is deviated towards the Class II side, which shows shorter ramus length, condylar height, larger Frontal ramus inclination, and superior positions of Gonion and U6, resulting in an occlusal canting (up towards the Class II side).
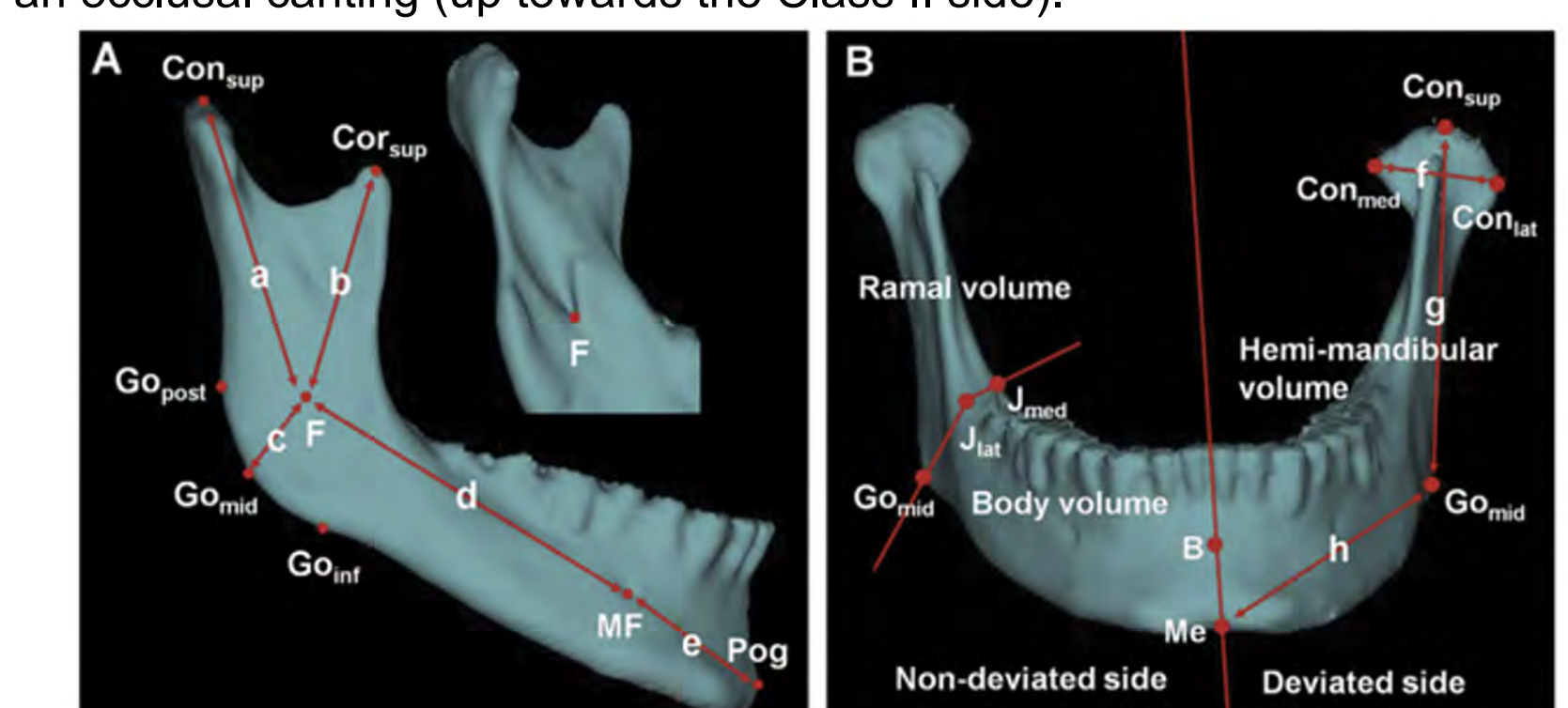

Figure 5. You KH, Lee KJ, Lee SH, Baik HS. Three-dimensional computed tomography analysis of mandibular morphology in patients with facial asymmetry and mandibular prognathism. Am J Orthod Dentofacial Ortho 2010;138(5):540.e1-541.

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