

Correlation Between Curve of Spee and Vertical Divergence in Skeletal Class II

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BACKGROUND



HYPOTHESIS



**METHODS &
MATERIALS**



RESULTS



DISCUSSION

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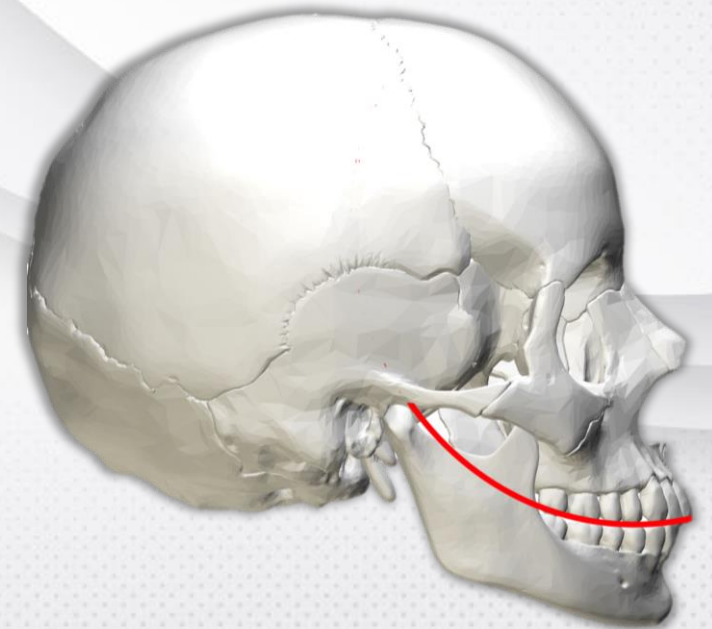
BACKGROUND

1890

- Ferdinand Graf von Spee described the natural curve of the occlusion from the sagittal view.
- Defined as “the line on a cylinder tangent to the anterior border of the condyle, the occlusal surface of the second molar, and the incisal edges of the mandibular incisors.
- His theory: the curve maintains maximum tooth contacts during chewing

“Fun” Facts

- The curve of the maxillary teeth is also called the curve of Spee (COS).
- COS by default refers to mandibular teeth, unless the maxilla is specified.



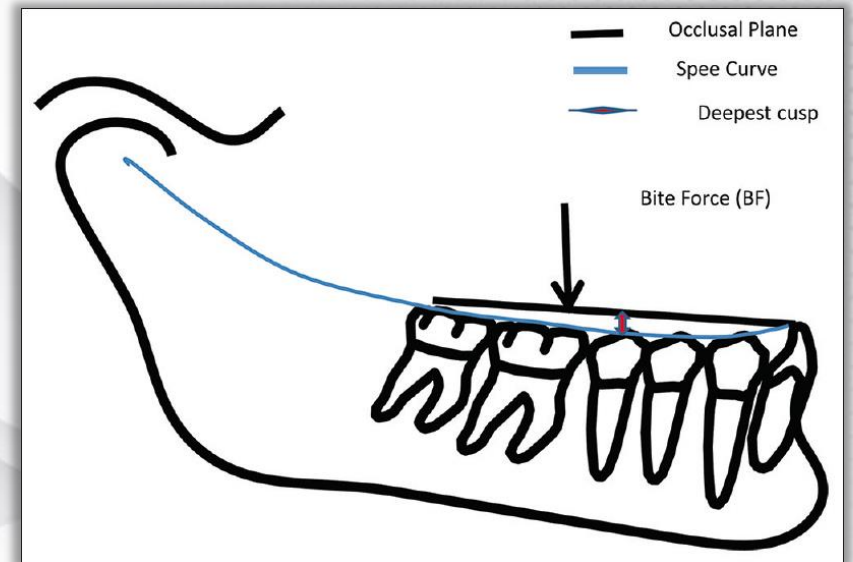
1972

- Lawrence Andrews wrote “The six keys to normal occlusion”.
 - A finding was ‘normal’ patients either had a flat COS, or it was ‘mild’.
 - Genesis of the straight-wire appliance, with a goal of leveling the COS.



What is the purpose of the COS?

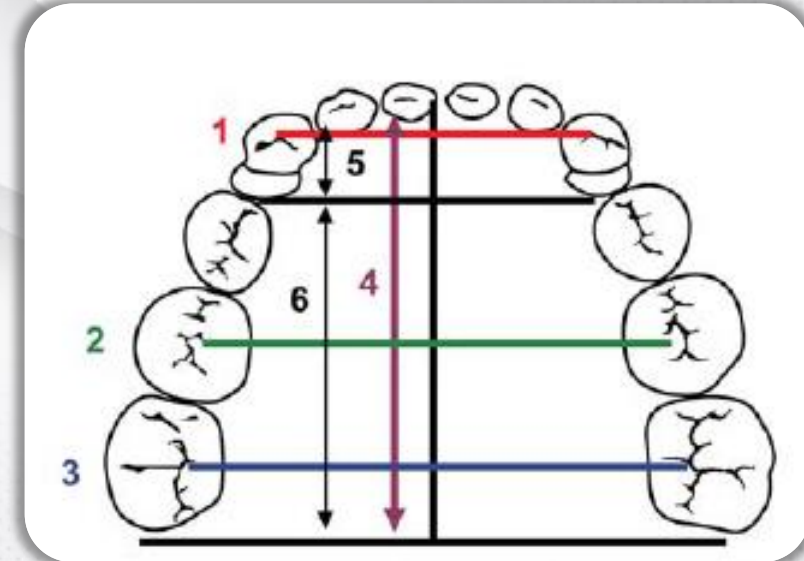
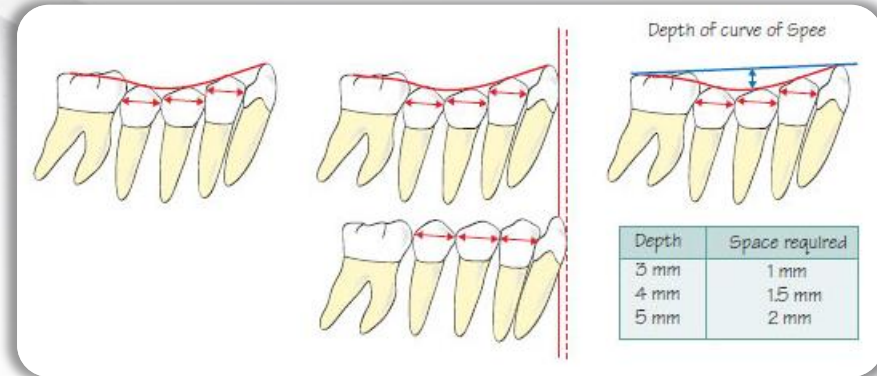
- Not fully understood
- May make it possible for teeth to resist forces of mastication ^{1,2,3}
- Increases the crush-shear ratio and improves the efficiency of occlusal forces during mastication ⁴
- Prosthodontics: COS in harmony with the condylar guidance is believed to improve denture stability ⁵



BACKGROUND

Does leveling the Curve of Spee require space?

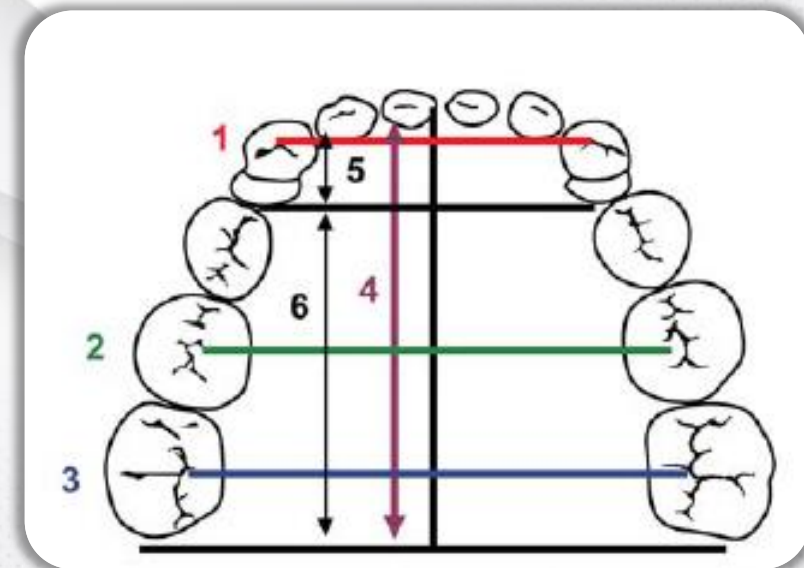
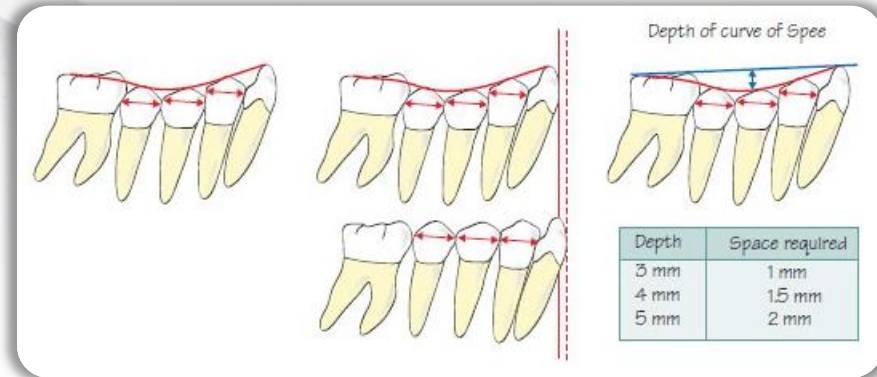
- Proffit: 1 mm of arch length is needed for every mm of COS¹
- Baldrige: $Y = 0.488X - 0.51 \text{ mm}^2$
- Garcia: $Y = 0.657X + 1.34 \text{ mm}^3$
- Germane: space required is non-linear and the ratio is less than 1:1⁴



BACKGROUND

Does leveling the Curve of Spee require space?

- Multiple researchers have proposed ways to estimate the space needed to level the COS, however there is no consensus on how much space is required.^{1,2,3,4,5}
- Bottom line: space is needed



BACKGROUND

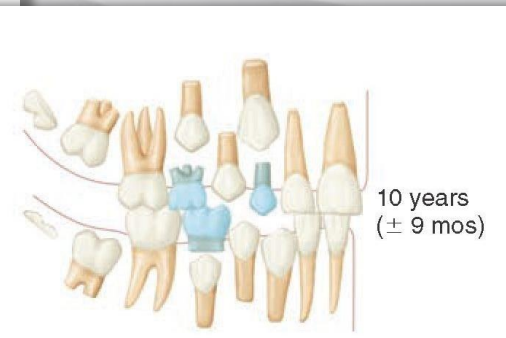
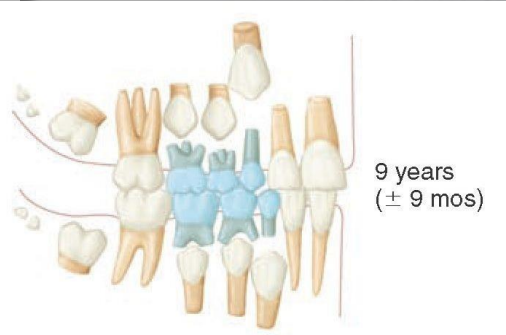
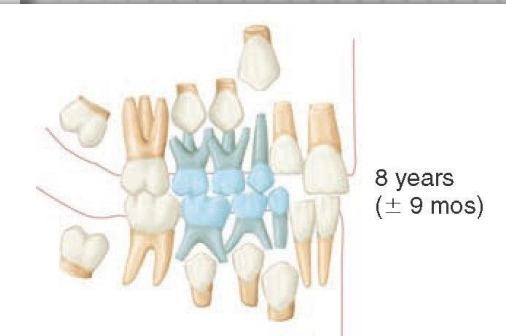
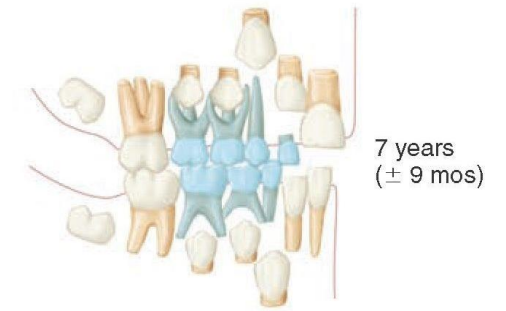
Development of the curve of Spee

Steven D. Marshall,^a Matthew Caspersen,^b Rachel R. Hardinger,^c Robert G. Franciscus,^d

Is the COS stable after it develops?

- Marshall looked at 33 patients
- COS first develops when the permanent mandibular 1st molars and incisors erupt
- COS remains stable until the mandibular 2nd molars erupt, causing it to **deepen**
- COS depth stable once eruption complete

mandibular arch of the sexes. Radiographic measurements of tooth eruption confirm that the greatest increases in the curve of Spee occur as the mandibular permanent incisors, first molars, or second molars erupt above the pre-existing occlusal plane. **Conclusions:** On average, the curve of Spee initially develops as a result of mandibular permanent first molar and incisor eruption. The curve of Spee maintains this depth until the mandibular permanent second molars erupt above the occlusal plane, when it again deepens. During the adolescent dentition stage, the curve depth decreases slightly and then remains relatively stable into early adulthood. (Am J Orthod Dentofacial Orthop 2008;134:344-52)



al curvature viewed in
nce in orthodontics and
velops. The purpose of this
ve of Spee longitudinally
dentition to adulthood.
Study were selected and
t 7 time points from ages
est was used to compare
e relative eruption of the
and its contribution to the
curve of Spee is minimal.
nd 0.25 mm, respectively.
mandibular permanent first
n increases significantly
ins essentially unchanged
reases ($P < 0.0001$) to a
ears), the depth decreases
entition (mean age 26.98
f 2.02 mm. No significant
ght and left sides of the



BACKGROUND

Is there a correlation between the anterior-posterior skeletal classification and the COS depth?

- One study: COS positively correlated to ANB and negatively correlated SNB
 - 49 patients total
 - All Korean nationality
 - Relatively low variation in ANB (2.42 +/- 2.48)

↑ ANB = ↑ COS

↓ SNB = ↑ COS

BACKGROUND

Is there a correlation between the molar classification and the COS depth?

- Class II malocclusions have the deepest COS^{1,2,3,4}
- Debate whether Division 1 or 2 are deeper

Class II - Division 1



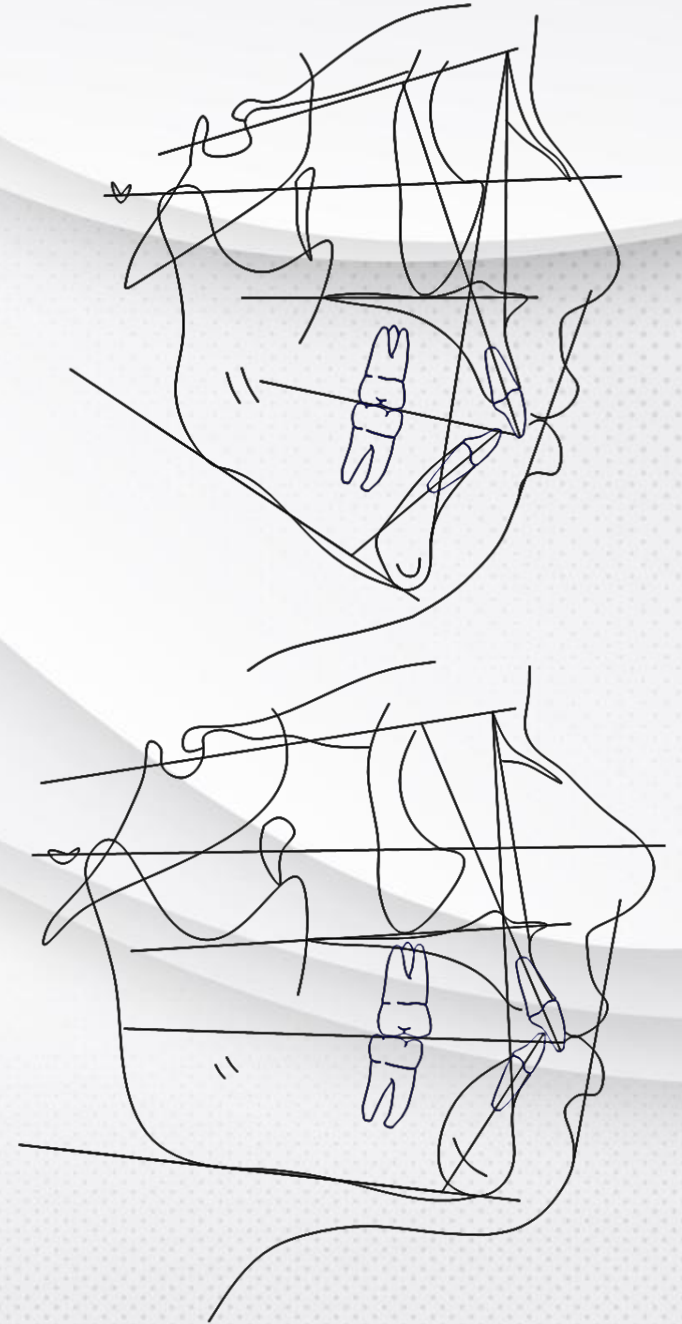
Class II - Division 2



BACKGROUND

Is there a correlation between the skeletal divergence and the COS depth?

- Low mandibular plane angles have deeper COS^{1,2}
 - Some disagreement^{3,4}



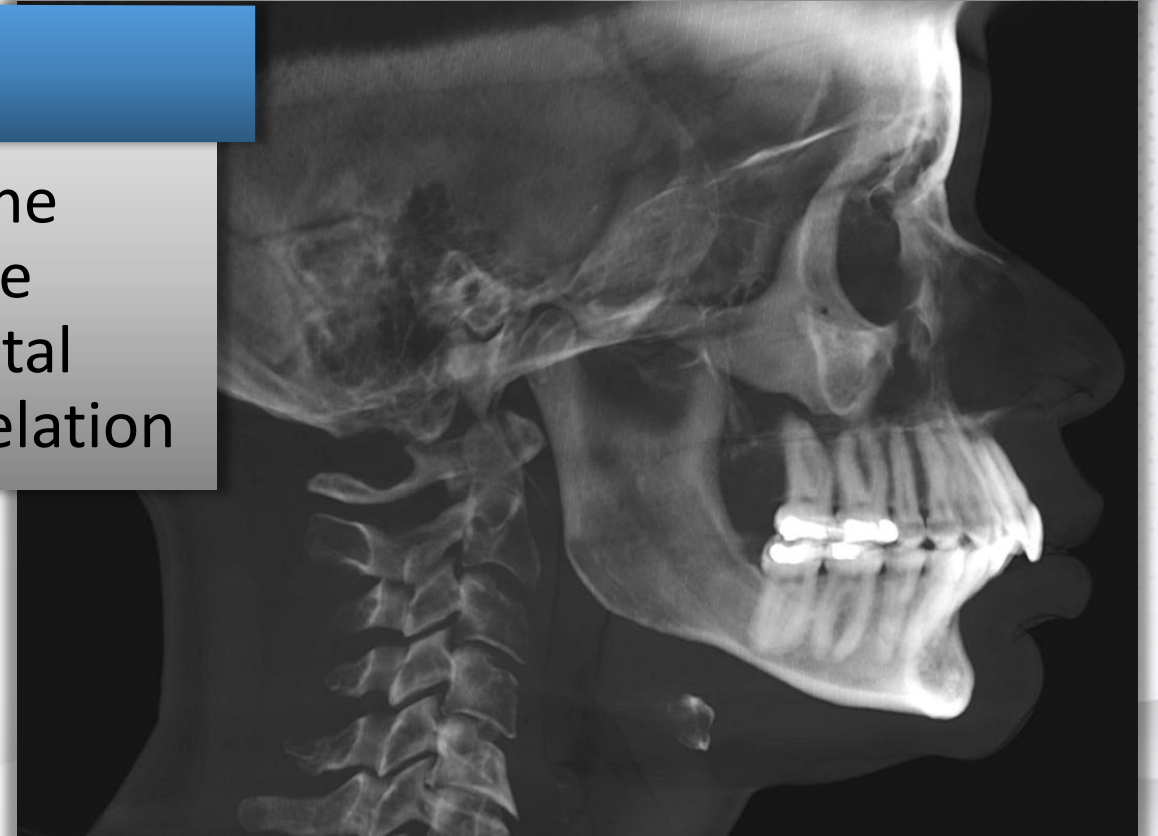
Summing it up

- The COS has separately been found to be deeper in:
 - Class II patients
 - Class II skeletal patterns
 - Hypodivergent patients
- So.....



Objective of Study

- The goal of this study is to measure the COS and the various mandibular plane angles in patients with a Class II skeletal profile to determine if there is a correlation





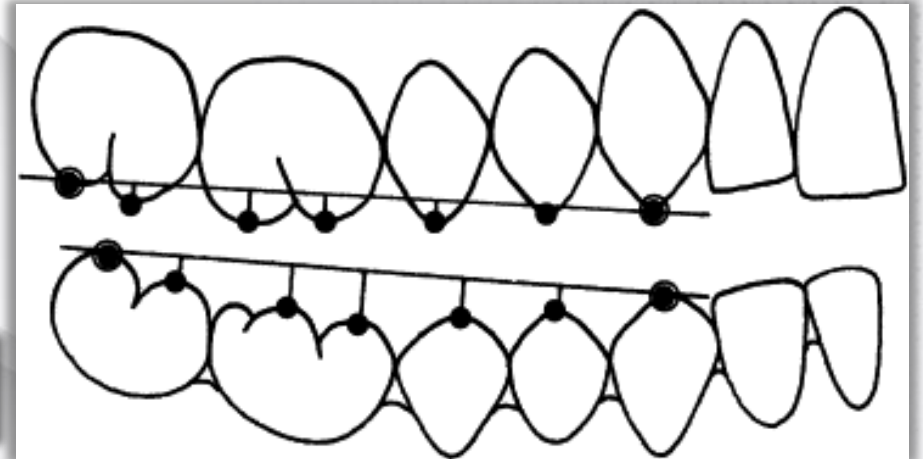
HYPOTHESIS

Hypothesis

Hypodivergent skeletal patterns will exhibit a greater COS and there is a correlation between the mandibular plane and the depth of the COS in Class II patients

Null Hypothesis

There will be no correlation between the mandibular plane and the COS depth



TORP Dolphin search

Initial search for ANB > 4°
Over 3700 results

Grouped by skeletal divergence

20 patients per group:

Hyperdivergent

FMA > 29°

Normodivergent

FMA 20-29°

Hypodivergent

FMA < 20°

Inclusion criteria

A complete permanent dentition

Skeletal Class II profile (ANB > 4°)

No previous orthodontic
treatment

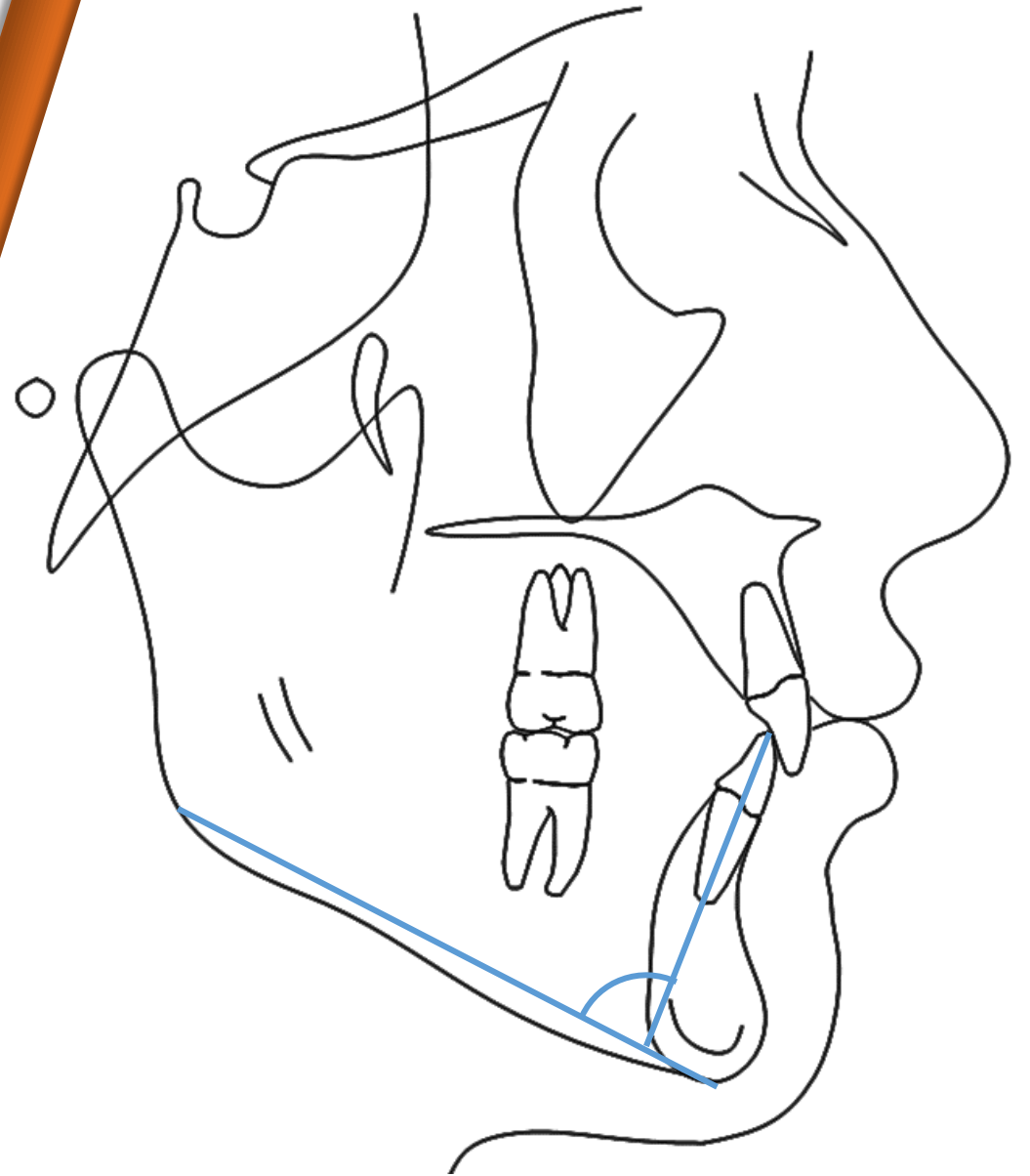
Dental casts and CBCT available

No craniofacial anomalies

METHODS & MATERIALS

Points measured and recorded for each patient:

- SNA
- SNB
- ANB
- A-N Perp
- B-N Perp
- Pog-N Perp
- SN-MP
- FMA
- OP-MP
- SN-OP
- U1-NA
- U1-SN
- L1-NB
- L1-MP



Summary

TORP Ceph Analysis:

MP uses Gnathion and Gonion

TORP CEPH 2020:

FMA and MP-SN use Gonion

SN-MP uses Constructed Gonion

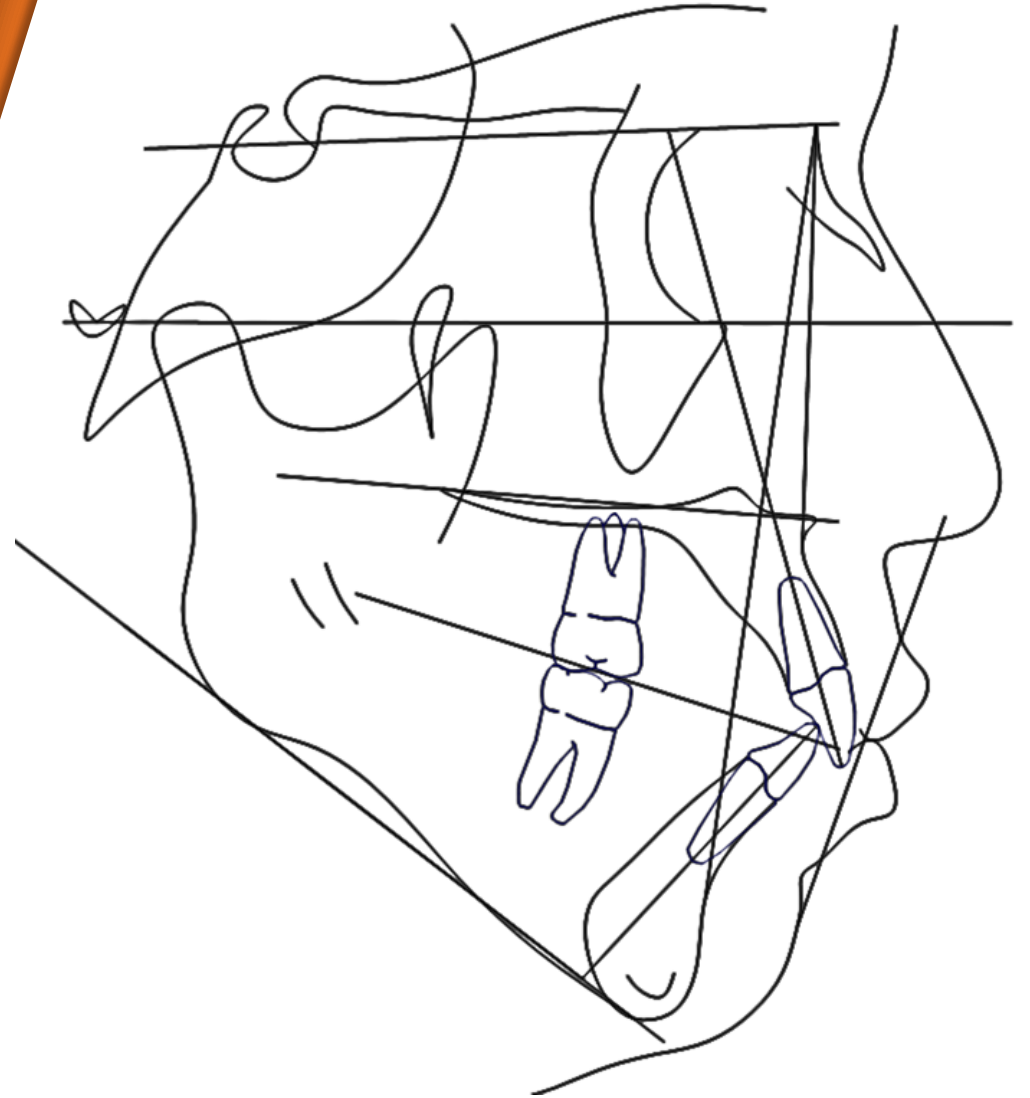
L1-MP uses Constructed Gonion

ABO:

FMA uses Constructed Gonion

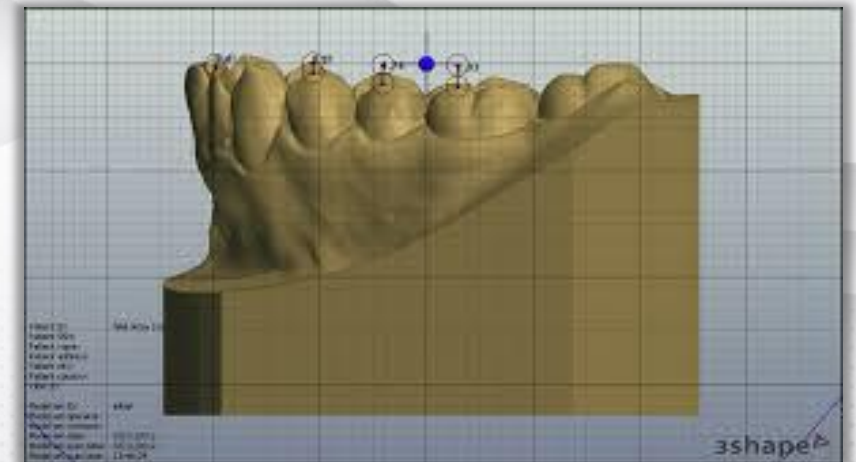
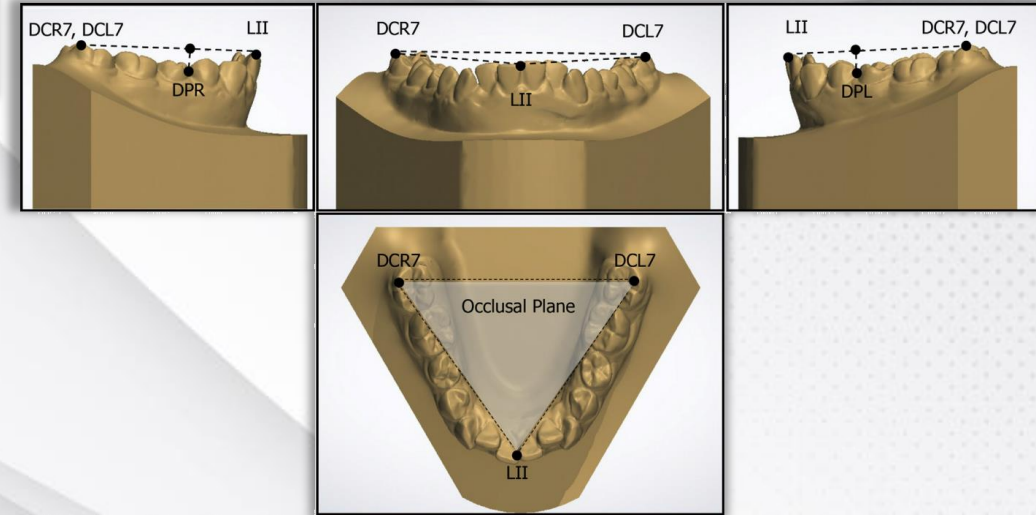
SN-MP uses Gonion

IMPA uses Constructed Gonion

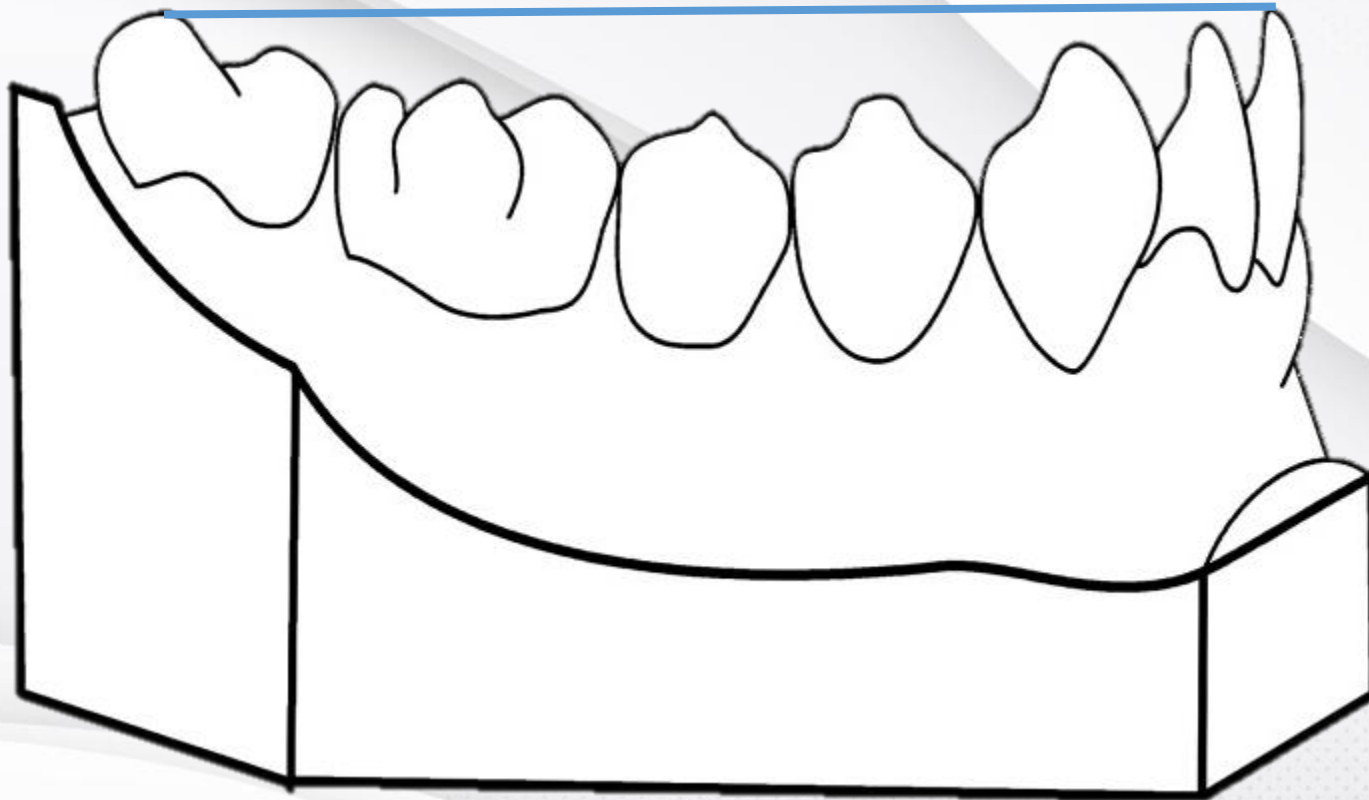


Measuring the COS- 3Shape¹

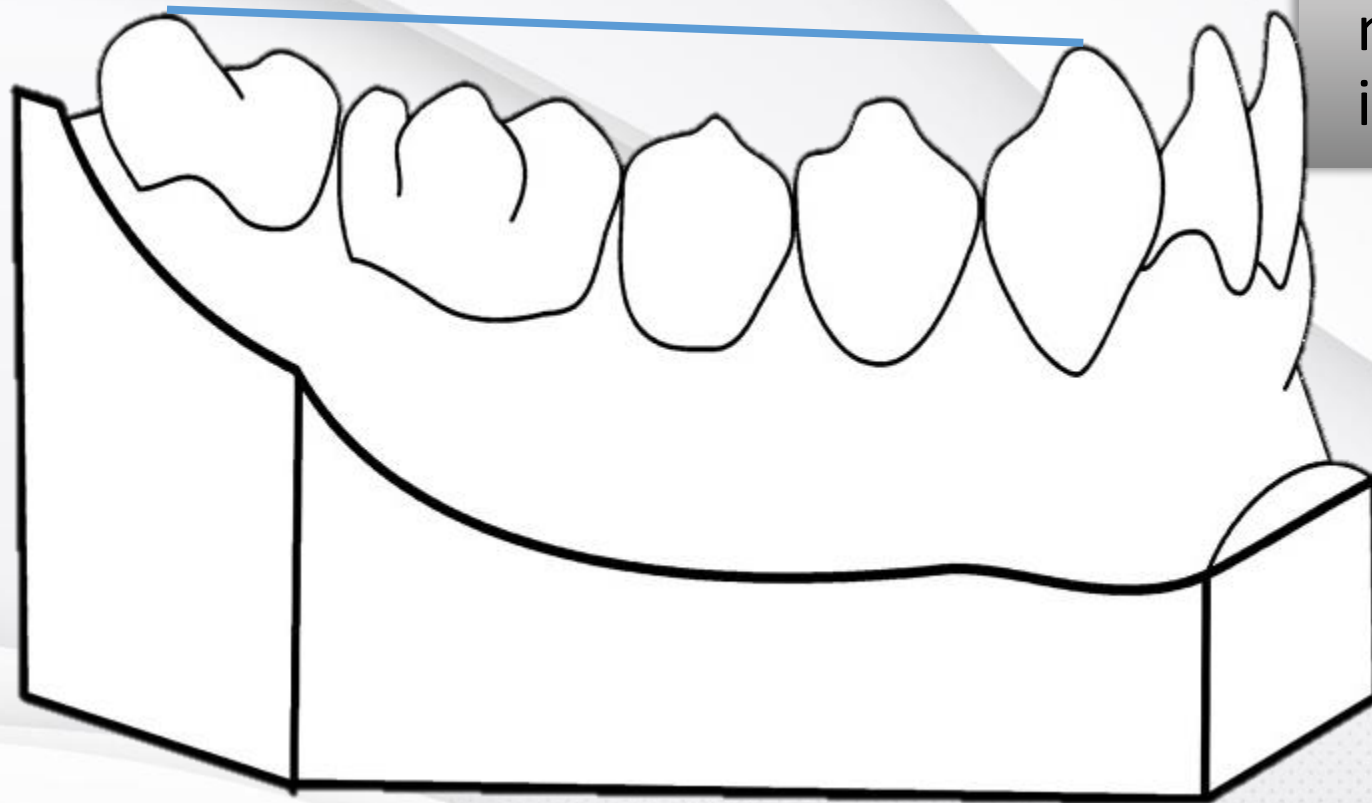
- Established occlusal plane with 3 points
 - Distobuccal cusp of the 2nd molar on each side
 - Midpoint of the incisal edges of the central incisors
- COS measured from this reference plane to each cusp tip
 - Deepest value was recorded for each side
 - Cusp tip must be in contact for depth to be measured
- Average COS depth (left and right) recorded for each patient



DB cusp to central incisor 1,2,3,4,5,6,7,8



DB cusp to canine^{1,2,3}



Special mention⁴

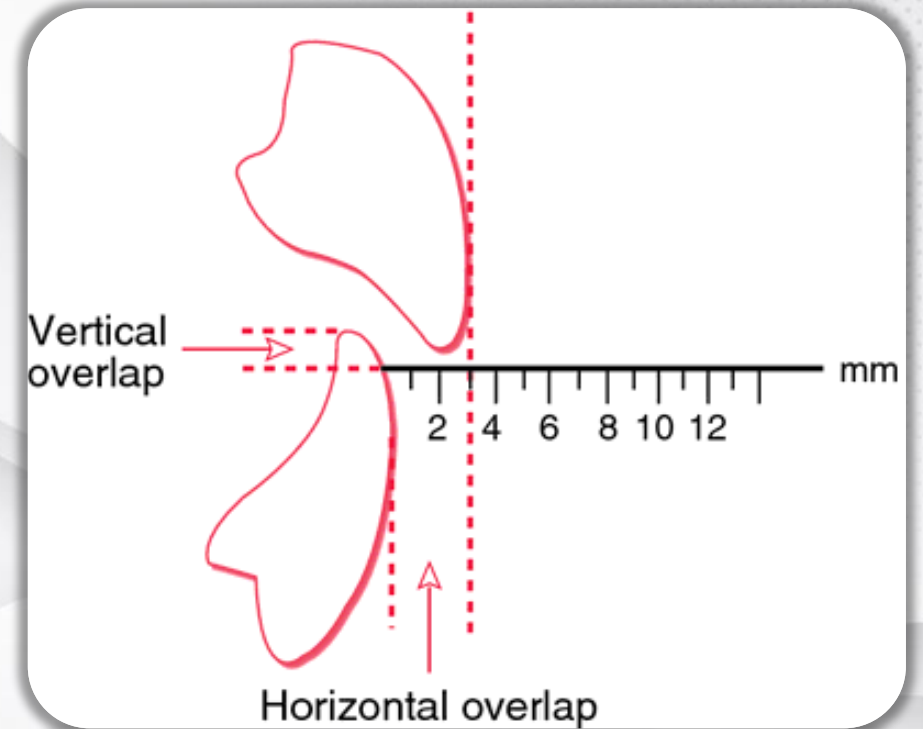
- Most overerupted molar cusp and incisor

Overjet¹

- Horizontal measurement between the incisal edge of the mandibular central incisor and the incisal edge of the facial surface of the maxillary central incisor

Overbite¹

- Vertical measurement between the incisal edges of the maxillary and mandibular central incisors

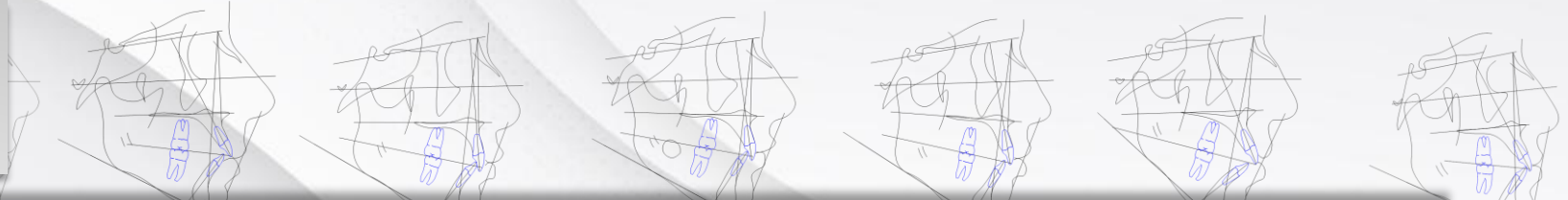


Intrarater reliability

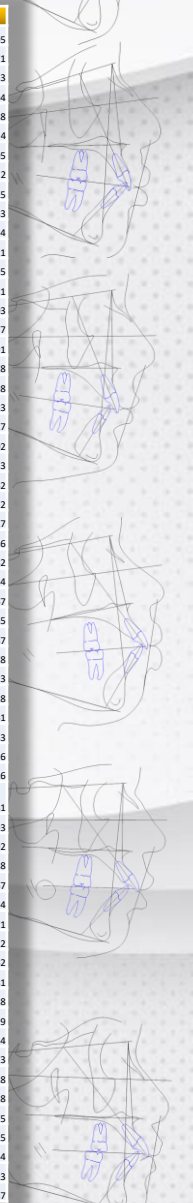
- Randomly selected 20 lateral cephs AND 20 casts to repeat measurements



RESULTS



Research ID	Age at Tx Start	Ethnicity	Gender	Divergence	SNA	SNB	ANB	A-N Perp	I-N Perp	Pop-N Perp	SN-MP	FMA	OP-MP	SN-OP	U1-NA	U1-SN	I1-NB	I1-MP	IOS Average	Overbite	Overjet	
1	22.7	Caucasian	Male	Hypodivergent		83	77.8	5.1	-2.6	-13.8	-11.6	23.8	18.8	8.9	14.9	-3.6	80.4	0.7	90	1.55	7.66	2.05
2	21.3	Caucasian	Male	Hypodivergent		91.5	82.6	8.9	9	-2.3	-2.3	19.9	13.7	11	8.9	-6.3	81.3	5.7	100.7	3.25	9.13	1.71
3	28.4	Hispanic	Female	Normodivergent		75.3	71.1	4.3	-5.3	-16.3	-14.9	35.5	25.7	14.8	20.7	1.5	84	4	91.3	2.52	5.72	3.33
4	22.9	Caucasian	Female	Normodivergent		86.5	76.9	9.6	3.5	-11.1	-13.5	32.3	25.6	16.5	15.8	-4.1	85.9	7.3	102.9	1.68	7.37	3.94
5	32.2	Caucasian	Male	Hypodivergent		88.2	81.7	6.5	8	0.5	5.8	23	14.3	13.8	9.2	-1.8	97.3	1.4	88.7	3.27	10	6.28
6	31.8	Hispanic	Female	Hyperdivergent		81.8	73.7	8.1	-2.4	-18	-20.5	42	36.3	17.1	24.9	2	86.7	11	97.7	2.28	4.59	4
7	33.8	Caucasian	Female	Hypodivergent		83.6	79.2	4.4	-1.8	-10.4	-5.5	22.8	18.1	14.7	8.1	-0.5	88.6	2.4	98.5	2.20	4.16	3.05
8	38.1	Caucasian	Male	Normodivergent		78.9	74.8	4.1	-3.1	-12	-10.7	32.7	24.5	16.2	16.5	0.9	89.3	4	92.1	1.82	1.96	2
9	16.3	Caucasian	Male	Hyperdivergent		81.7	77	4.7	-2.7	-12.7	-10.4	37.3	31.6	20.6	16.7	-0.2	89.3	4.2	83.8	2.60	6.36	2.5
10	21	Caucasian	Female	Hyperdivergent		77.9	73	5	-4.1	-16.3	-15.7	43.8	35.8	21.7	22.1	2.6	90	5.7	86.6	1.61	2.73	3.43
11	24.3	Asian	Female	Hyperdivergent		73.1	64.7	8.4	-3.2	-23.5	-23.7	52.4	38.1	24.1	28.3	4	91.9	12.9	104	1.44	0.43	4.54
12	16.3	Indian	Male	Hypodivergent		80.6	76.7	4	-0.5	-7.1	-5.4	25.7	16.7	9.9	15.8	2.2	93.8	3	101	2.26	6.47	4.11
13	40.4	African American	Male	Hypodivergent		90.2	82	8.1	7.5	-0.7	-0.5	24	16.4	10	14	0.6	94.5	6.2	96.3	2.15	7.3	3.95
14	42.6	Hispanic	Male	Normodivergent		84.8	79.2	5.6	1	-7.6	-6.3	34.1	27.8	17.9	16.2	1.1	94.9	5.4	89.1	2.15	5.19	4.11
15	20.4	African American	Female	Hyperdivergent		78.9	69.6	9.3	-1.5	-18.8	-19.7	41.9	32.2	17.8	24.1	2.8	96.2	13.6	110.4	2.40	5.41	5.03
16	46.2	Hispanic	Male	Hyperdivergent		80.9	71.3	9.6	5.3	-9.6	-11.4	47.5	33.7	26.4	21.1	2.1	96.3	13.1	96.3	1.32	1.73	3.77
17	20	Hispanic	Female	Normodivergent		78.2	73.6	4.6	-2.6	-12.3	-13.3	32.2	22.8	12.1	20.1	4.2	96.6	5.2	97.3	2.20	6.63	4.91
18	13.6	Caucasian	Male	Normodivergent		84.1	78.1	6	0.3	-8.5	-8.7	32.3	26.1	15	17.3	-0.1	97.3	5.1	105.3	2.37	2.73	1.78
19	42.8	African American	Female	Hyperdivergent		86.2	80.9	5.3	6.8	3	2.4	43.1	32.4	25.8	17.3	2	97.6	7.4	78.4	1.27	1.68	1.98
20	16.8	African American	Female	Hypodivergent		90.2	84	6.2	6.9	3	2.9	18.4	10.3	7.6	10.8	2.7	104.1	7	113.3	1.41	4.93	3.43
21	41.7	Caucasian	Female	Hyperdivergent		79.7	75.1	4.6	-1.1	-8.6	-9	40.7	31.5	25.4	15.3	3.7	98	3.3	82.1	2.37	6.83	5.7
22	15.3	Hispanic	Female	Hypodivergent		86.5	82.2	4.3	4.4	0.4	3	19	11	10.1	8.9	3.7	110.9	4.9	109	1.81	3.78	4.02
23	28.4	African American	Female	Normodivergent		81.9	75.4	6.5	0	-10.9	-10.7	37	28.8	16.6	20.4	5.1	99.3	10.2	102.4	2.54	4.52	5.33
24	14.5	Caucasian	Male	Normodivergent		81.8	77.2	4.6	2.1	-4.2	-3	36.1	25.7	18.6	17.5	3.7	99.6	6.8	93.8	2.29	3.38	3.62
25	23.1	Caucasian	Male	Normodivergent		87.9	83.1	4.8	3.8	-1.8	0.2	30.9	25	21.6	9.3	2	100	6.4	95.3	1.46	2.72	2.22
26	25.8	Caucasian	Female	Hyperdivergent		76	70.1	6	-4.6	-18.2	-20	53.5	44.3	29.5	24	7.8	102.3	11.2	97.7	1.75	0.5	4.7
27	28.3	Caucasian	Female	Hypodivergent		89.4	84.4	5	4.9	-0.3	6.2	16.4	11	14.6	1.8	1.2	102.5	1.7	93.2	2.84	6.58	4.46
28	33.3	African American	Male	Normodivergent		82.2	77.8	4.4	-2.1	-11.4	-9.4	34.5	28.7	23.4	11.1	6.2	102.5	4.7	85	2.17	6.56	7.42
29	13.2	Caucasian	Male	Normodivergent		81.9	76.6	5.3	-0.2	-8.7	-8	32.8	24.9	16	16.8	2.9	102.8	4.9	96.9	2.90	4.24	4.44
30	14.4	Caucasian	Female	Normodivergent		81.3	76.5	4.7	-2.9	-12.9	-12.4	33.1	27.4	21.6	11.5	5.9	103	7.9	99	3.12	6.19	5.67
31	36.3	Hispanic	Female	Hyperdivergent		86.1	79.8	6.3	-1.6	-13.5	-14.8	40.8	38.7	21	19.8	5.7	103.2	10.7	94.1	2.06	3.36	4.45
32	43.6	Hispanic	Male	Hypodivergent		86.6	79.8	6.7	3.6	-4.9	-1.8	24.4	17.4	13.1	11.3	-0.6	94.2	4.3	97.2	2.56	6.5	3.87
33	21.7	African American	Male	Hypodivergent		88	80.8	7.2	9.8	5.2	6.8	23.4	11	10.7	12.7	3.7	104.4	9.7	111.8	1.95	5.57	4.78
34	32.3	Hispanic	Male	Hypodivergent		88.8	83	5.8	4	-4.2	-1.4	23.5	18.8	14.5	9	2.4	104.7	7.3	101.8	1.05	3.24	3.23
35	16.4	African American	Female	Hypodivergent		83	77.2	5.8	0.7	-7.3	-5.5	25.7	17.8	13.5	12.2	4	102	5.8	107.9	2.61	6.52	6.28
36	38.4	Caucasian	Male	Hyperdivergent		81.9	73.9	7.9	-1	-15.7	-16.9	42.5	35.3	26.1	16.4	6.3	105.2	8.7	92.4	5.05	7.94	11.61
37	26	Asian	Female	Hyperdivergent		82.6	75.1	7.4	-3.2	-18.6	-19.1	38.8	34.4	22.6	16.2	5.5	105.4	11.2	98.9	2.25	4.96	7.83
38	14.7	Hispanic	Male	Hypodivergent		90	82.5	7.5	6.6	-0.1	0.7	22.7	15.3	14	8.7	2.6	105.5	7	102.7	3.41	4.73	5.16
39	43.4	Caucasian	Female	Hyperdivergent		84	79.9	4.1	-0.8	-8.3	-9.6	38.6	33.4	22	16.6	4.6	106	7.9	95.5	1.64	2.15	2.6
40	26.3	Hispanic	Male	Hyperdivergent		81.7	76.9	4.8	0.9	-8	-6	41.3	32.3	22.5	18.8	3.4	106.6	8.7	92.7	0.81	1.42	1.81
41	19.5	Caucasian	Male	Normodivergent		84.4	80.3	4.1	-0.4	-7.5	-6.5	30.7	25.5	21.9	8.8	5.9	107.2	7.5	98.4	3.54	4.5	3.93
42	23.6	Asian	Female	Normodivergent		84	79.5	4.4	0.9	-6.1	-5.3	33.9	26.9	17.9	16	6	107.3	9	106.7	2.52	1.41	2.92
43	27.1	African American	Male	Normodivergent		92.4	85.1	7.3	8.7	3.3	4.1	30.7	23.9	21.2	9.5	3.6	107.5	10.4	94	2.29	4.97	3.58
44	41.1	Hispanic	Female	Hyperdivergent		83.5	77.5	5.9	-0.2	-9.6	-9.3	37.7	31.3	22.4	15.3	4.6	107.9	7.9	98	2.94	1.31	3.67
45	15.3	Caucasian	Male	Normodivergent		82.9	77.2	5.8	2.5	-5.8	-5.9	32.3	22.8	19.4	12.9	5.3	108.4	8.1	97.5	2.61	4.9	5.34
46	24.7	Hispanic	Female	Hyperdivergent		83.6	77.5	6.1	-0.9	-12.5	-13	40.9	35.5	21.9	19	7.2	108.9	11.3	96	1.21	1.3	2.71
47	17.1	Caucasian	Female	Hyperdivergent		80.5	75.4	5.1	-3.3	-14.1	-14.1	39.2	33	21	18.2	1.6	89.7	5.1	92.1	1.60	4.51	4.2
48	17.6	Caucasian	Female	Hyperdivergent		80.5	73.1	7.4	-0.5	-13.7	-13.8	42.6	33.6	20.6	22	0.2	83.9	8.4	96.5	3.04	5.95	3.62
49	16.6	African American	Male	Hyperdivergent		85.7	78.7	7	0.8	-11.2	-13.9	40.3	35.3	24.8	15.5	7.7	110.4	14.1	98.4	1.82	3.9	4.81
50	16.1	Caucasian	Female	Hypodivergent		84.7	77.5	7.2	2.5	-5.7	-3.4	24.3	16.1	16.6	7.7	5.1	111.2	3.8	101.8	2.82	6.39	9.58
51	21.3	Caucasian	Male	Hypodivergent		85.1	79	6.1	1.2	-7.2	-3.8	24.8	18.7	14.2	10.6	-3.3	81.5	0.7	87	4.42	10.17	3.19
52	18	Hispanic	Male	Hypodivergent		86.7	82.7	4	3.1	-1.4	0.5	18.6	12.1	7.8	10.8	6.5	112.1	6.1	104.8	2.49	5.85	5.44
53	17.4	Hispanic	Female	Hyperdivergent		83.8	77.2	6.7	-3	-16.1	-15.8	40.5	37.3	20	20.5	4.2	112.8	8.6	92.6	1.58	0.7	4.73
54	37.4	Caucasian	Male	Normodivergent		86.1	80.9	5.2	1.4	-6.7	-5.2	32.4	27	22.4	10	6	114.6	9.2	96.7	1.63	4.32	3.28
55	22	African American	Male	Normodivergent		92.8	85.7	7.1	5.6	-2.1	-4.3	28.3	25.2	22	6.3	7.2	115.2	14.2	102.1	1.67	3.71	3.58
56	27	Caucasian	Female	Normodivergent		77.2	72	5.1	-5.7	-17.4	-17.8	33.1	26.3	24.3	8.8	13.2	117.8	8.9	109.8	3.84	5.65	12.75
57	15.6	Caucasian	Male	Normodivergent		81.5	75.5	6	-0.5	-10.5	-6.6	32.7	24.7	23.3	9.4	6.6	118	6.6	102	2.73	3.98	9.5
58	20.5	Hispanic	Male	Hypodivergent		88	83.3	4.8	5.4	0.5	2.7	22.4	15.5	14.7	7.7	10.1	122.6	9.9	109.8	2.59	4.45	5.64
59	17.3	African American	Male	Hypodivergent		86.7	81.5	5.2	-0.7	-10.4	-10	21.2	18.6	16.6	4.6	12.6	122.9	12	115.6	2.30	2.89	6.3
60	25.7	African American	Male	Hypodivergent		89.9	84.6	5.4	2.1	-5.8	-5	21.2	18.9	18	3.2	11.5	127.7	12	110.6	1.67	5.04	6.47





RESULTS

Patient Demographics

- **Mean Age:** 25.5 years at time of records
 - **Age range:** 13.2-46.2 years old
- **Gender:** 28 female: 32 male
- **Ethnicity:** 45% Caucasian
27% Hispanic
22% African American
5% Asian
1% Indian

RESULTS



COS Average

Group		COS
Hypodivergent	Mean	2.29
	SD	0.66
	Range	1.05-3.59
Normodivergent	Mean	2.4
	SD	0.62
	Range	1.46-3.84
Hyperdivergent	Mean	2.05
	SD	0.92
	Range	0.81-5.05

RESULTS

COS by Skeletal Divergence

Group		SNA	SNB	ANB	A-N Perp	B-N Perp	Pog-N Perp	SN-MP	FMA	OP-MP	SN-OP	U1-NA	U1-SN	L1-NB	L1-MP	COS Average	Overbite	Overjet
Hypodivergent	Mean	87	81.1	5.91	3.71	-3.6	-1.38	22.26	15.53	12.72	9.55	2.64	102.1	5.58	102.1	2.43	2.43	4.65
	SD	2.94	2.49	1.39	3.62	4.9	5.09	2.61	3.04	3.01	3.61	4.92	13.61	3.46	8.36	0.79	0.79	1.82
	P Value	0.98	0.46	0.19	0.6	0.93	0.66	0.56	0.91	0.29	0.65	0.17	0.2	0.11	0.04		0	0.57
	Pearson Correlation	-0	-0.18	0.3	0.13	0.02	0.11	0.14	0.03	0.25	-0.11	-0.32	-0.08	-0.37	-0.47		0.63	0.14
Normodivergent	Mean	83.3	77.8	5.48	0.35	-8.53	-7.91	32.88	25.77	19.14	13.75	4.16	102.6	7.29	97.88	2.4	4.53	4.68
	SD	4.46	3.88	1.36	3.52	4.99	5.22	1.99	1.68	3.45	4.47	3.53	9.8	2.56	6.15	0.62	1.59	2.63
	P Value	0.04	0.06	0.19	0.03	0.06	0.1	0.45	0.77	0.38	0.73	0.01	0.15	0.94	0.12		0.47	0.005
	Pearson Correlation	-0.5	-0.43	-0.3	-0.5	-0.42	-0.38	0.18	0.07	0.21	-0.08	0.56	0.33	-0.02	0.36		0.17	0.61
Hyperdivergent	Mean	81.5	75	6.49	-1.02	-13.2	-13.72	42.27	34.8	22.67	19.61	3.89	99.42	9.25	94.21	2.05	3.39	4.38
	SD	3.31	4	1.61	2.86	5.64	5.91	4.32	3.14	3.03	3.7	2.32	8.64	3.14	7.35	0.92	2.32	2.19
	P Value	0.92	0.73	0.32	0.47	0.37	0.34	0.39	0.63	0.98	0.32	0.91	0.74	0.54	0.85		0	0
	Pearson Correlation	0.03	-0.08	0.24	-0.17	-0.21	-0.22	-0.2	-0.11	-0.01	-0.23	0.03	-0.08	-0.15	0.05		0.72	0.74

Bold indicates significant findings

RESULTS

COS by Skeletal Divergence

Group		SNA	A-N Perp	U1-NA	L1-MP	Overbite	Overjet
Hypodivergent	Mean				102.09	2.43	
	SD				8.36	0.79	
	P Value				0.04	0	
	Pearson Correlation				-0.47	0.63	
Normodivergent	Mean	83.31	0.35	4.16			4.68
	SD	4.46	3.52	3.53			2.63
	P Value	0.04	0.03	0.01			0.005
	Pearson Correlation	-0.46	-0.5	0.56			0.61
Hyperdivergent	Mean					3.39	4.38
	SD					2.32	2.19
	P Value					0	0
	Pearson Correlation					0.72	0.74

RESULTS

COS Correlation Combined

Group		SNA	SNB	ANB	A-N Perp	B-N Perp	Pog-N Perp	SN-MP	FMA	OP-MP	SN-OP	U1-NA	U1-SN	L1-NB	L1-MP	COS Average	Overbite	Overjet
COS Average	Mean	83.95	77.99	5.96	1.01	-8.44	-7.67	32.47	25.36	18.17	14.3	3.56	101.36	7.37	98.06	2.3	4.66	4.57
	SD	4.26	4.28	1.49	3.85	6.45	7.36	8.8	8.37	5.19	5.69	3.74	10.8	3.38	7.91	0.79	2.27	2.2
	P Value	0.87	0.72	0.64	0.77	0.84	0.86	0.13	0.14	0.63	0.06	0.94	0.76	0.04	0.96		0	0
	Pearson Correlation	-0.02	-0.05	0.06	-0.04	-0.03	0.02	-0.2	-0.19	-0.06	-0.25	-0.01	-0.04	-0.27	0.01		0.58	0.51

RESULTS

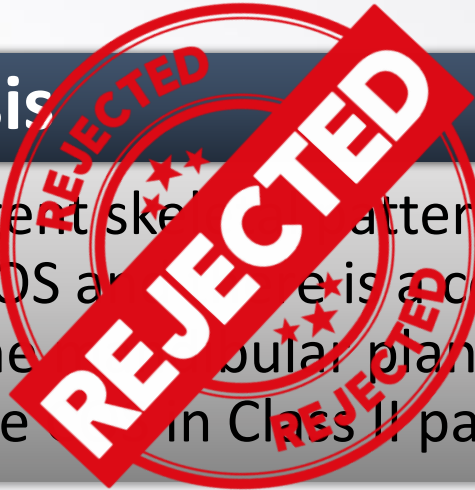
COS Correlation Combined

Group		L1-NB	Overbite	Overjet
COS Average	Mean	7.37	4.66	4.57
	SD	3.38	2.27	2.2
	P Value	0.04	0	0
	Pearson Correlation	-0.27	0.58	0.51

DISCUSSION

Hypothesis

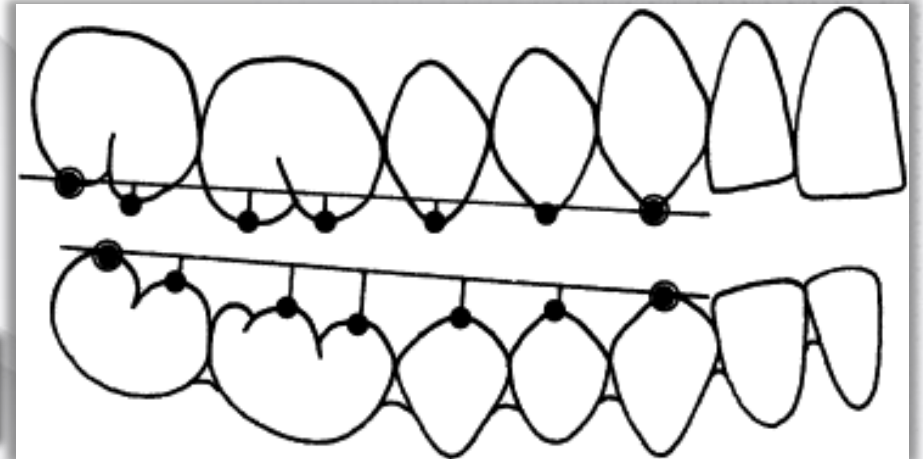
Hypodivergent skeletal patterns will exhibit a greater COS angle. There is a correlation between the mandibular plane and the depth of the overbite in Class II patients.



Null Hypothesis

There will be no correlation between the mandibular plane and the COS depth

Failed to Reject



Conclusions

- The COS was deeper when Overbite was greater
- The COS was deeper when Overjet was greater
- The more retrusive the lower incisors, the deeper the COS
- **The COS was not correlated to the mandibular plane**

↑ OB = ↑ COS

↑ OJ = ↑ COS

↓ L1-NB = ↑ COS

Correlation with OB and OJ

- Teeth erupt until in contact with opposing teeth (or gingiva)
- Theory: Deep COS is a compensation
 - Increased OJ leads to mandibular incisors being unopposed¹
 - OB develops as incisors erupt



Clinical Implications

- Deepbite correction mechanics influenced by skeletal divergence
- Understanding correlations can help clinician better plan treatment
- Any research adds to the greater body of knowledge



Limitations

- Did not screen patients based on:
 - Dental Classification
 - Ethnicity
 - Age
- Only looked at a narrow range (ANB >4)

Class II - Division 1

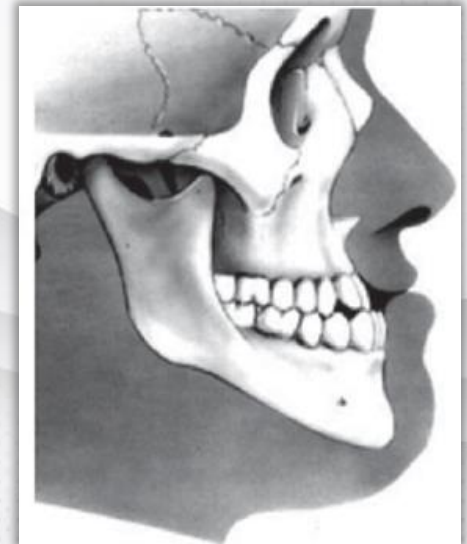
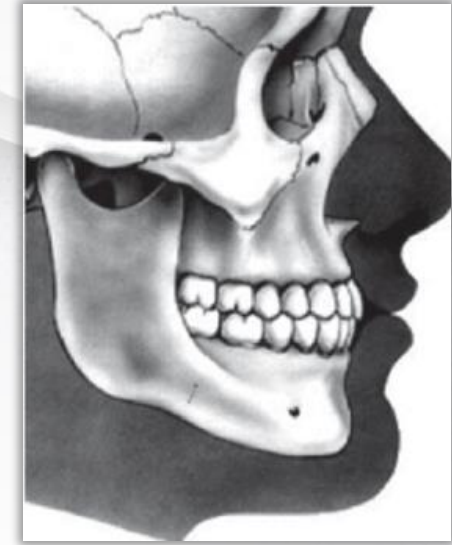


Class II - Division 2



Further studies.....

- Repeating study with Class I and III patients
- Compiling studies for better assessment
- Skeletal and dental Class synchronized





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