Clinical detection of transverse skeletal discrepancies derived from mandibular first molar buccal-lingual inclinations measured from CBCTs.

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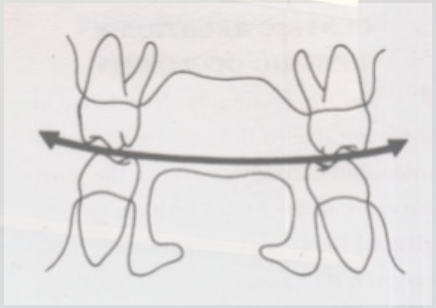
Background



Post treatment, American Board of Orthodontics defines an *optimum curve of Wilson* at a deviation of no more than a *1mm discrepancy* between the buccal and lingual cusps of the posterior teeth.

The optimum curve of Wilson is thought to exist for two purposes (Tong et al., 2012) :

- Optimal masticatory muscle loading
- Ease of food manipulation during function.

Deviation from the optimum curve of Wilson might be an indicator of a dental compensation for a transverse skeletal discrepancy between the maxillary and mandibular arches.

Purpose

The first part of this study will determine if there is a statistically significant correlation between a deviation from the ideal curve of Wilson and a transverse skeletal discrepancy using a CBCT.

"One of the advantages of using CBCT is the ability to visualize the whole tooth, thus removing some of the uncertainty in long-axis inclination that can result from using casts with uneven cusp wear or tooth morphology."(Alkhatib & Chung, 2017)

If a statistically significant positive correlation can be determined between first molar angulation (curve of Wilson) and a presence or absence of a skeletal transverse discrepancy, then these findings can be used to assess the use of molar angulation in a clinical setting to quickly visually assess a patient for skeletal transverse discrepancy without/prior to taking full diagnostic records (CBCT).

Methods & Materials

CBCT images will be acquired from the CBCT repository of the Department of Orthodontics and Dentofacial Orthopedics Repository (H-32515) of Boston University Henry M. Goldman School of Dental Medicine.

Males and females ages 6-10 with mandibular first molars erupted to at least the same occlusal plane level as the adjacent primary second molar.

No patients with gross anomalies, crossbites, gross restorations, gross cuspal wear of the mandibular first molars, or prior orthodontic treatment will be included in the study.

Evaluation and analysis of CBCT images will be performed using Dolphin. Specific measurements will be recorded, including the buccal lingual inclination of the mandibular first molars (Curve of Wilson) and the skeletal transverse width.

Methods & Materials

Transverse skeletal measurements will be taken between the palatal S' points and the lingual S' points. The skeletal measurements will be assessed to determine the amount of skeletal width discrepancy present.

Palatal S′ point	The point on the palatal cortex of the maxilla at a vertical level halfway between the buccal alveolar crest and the buccal root apex of the maxillary first molar
Lingual S′ point	The point on the lingual cortex of the mandible at a vertical level halfway between the buccal alveolar crest and the apex of the mandibular first molar

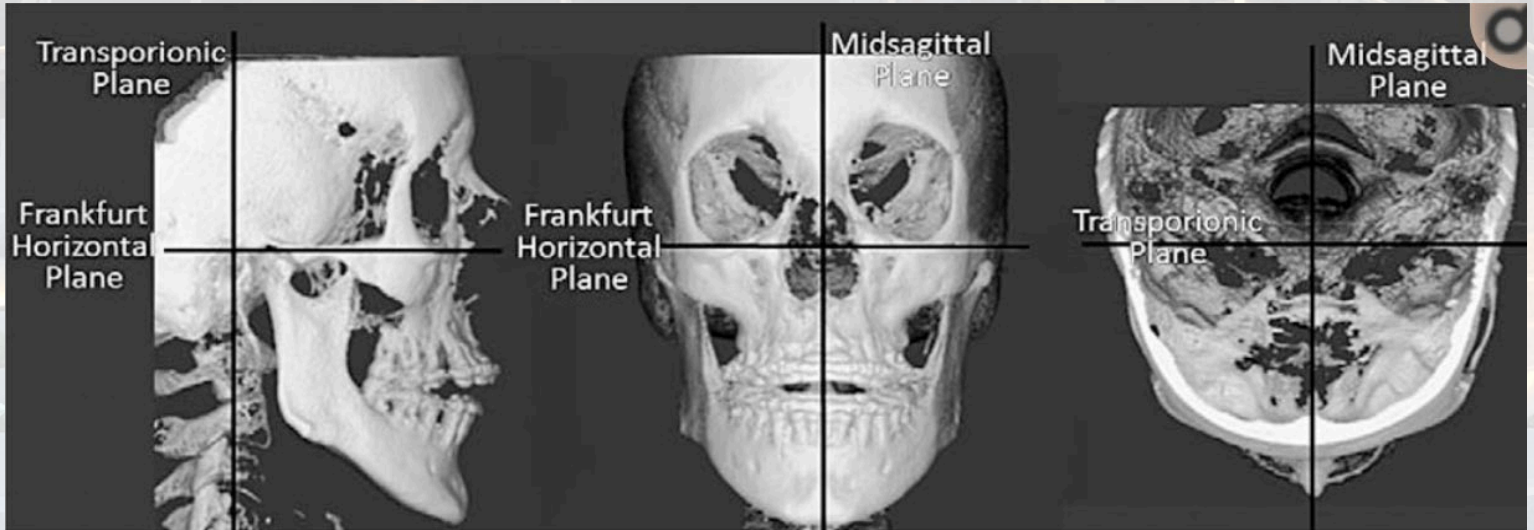
(Miner, Al Qabandi, Rigali, & Will, 2012)

Methods & Materials

The orientation of the CBCT to generate the PA Ceph and subsequently, the horizontal plane will be determined by the Frankfurt horizontal, midsagittal, and transporionic planes.

"The Frankfurt horizontal plane was defined bilaterally by the right and left porion and right and left orbitale landmarks. The midsagittal plane was defined by nasion (Na), anterior nasal spine (ANS), and basion landmarks. The transporionic plane was defined bilaterally by porion landmarks and perpendicular to the Frankfurt horizontal plane. In the sagittal, axial, and coronal views, the volume was rotated until the Frankfurt plane was oriented horizontally, and the midsagittal and transporionic planes were oriented vertically."

(Cevidanes et al., 2009)



Methods & Materials

The buccal-lingual inclination of the mandibular first molar will be determined by measuring the long axis of the tooth, relative to an occlusal plane.

Long axis, mandibular molar	The line drawn between the deepest concavity between the buccal and lingual cusps and the root apex

The occlusal plane will be defined by: the central groove of the first permanent molar AND the midpoint between any two completely erupted lower incisors, either deciduous or permanent.

Methods & Materials

The second phase of this study will examine the correlation between the curve of Wilson measured by CBCT AND the projection of the buccal surface of the mandibular first permanent molar onto the previously described occlusal plane.

The buccal surface of the tooth is defined as the perpendicular distance between the most lateral point of the gingival margin of the tooth to the line between the mesiobuccal and distobuccal cusp tips.

Interater Reliability Analysis will be completed.

Data Collection

Phase I

- Maxillary Skeletal Width
- Mandibular Skeletal Width
- Angulation of the Lower Left 1st Molar
- Angulation of the Lower Right 1st Molar

Phase II

Measure the buccal surface of the mandibular first permanent left and right molars projected onto the previously described occlusal plane

Statistical Analysis

- Mean, standard deviation, minimum and maximum were used as descriptive analysis.
- Student's T-test was used to compare between genders.
- Pearson correlation was used to examine the relationship between all the variables and in particular the difference between the angulation of the lower first molars, the maxillary width, mandibular width and the maxillary and mandibular width discrepancy.

Results – Phase I

Gender Analysis

60 Subjects: 48% Male, 52% Female

Variables	Male				Female				Mean Diff. (SD)	P-Value
	Mean	SD	Min	Max	Mean	SD	Min	Max		
Age (years)	8.29	1.00	6.08	9.92	8.37	1.04	6.25	9.92	-0.08 1.02	0.75
LL1st Molar	107.14	6.55	97.10	124.50	105.56	6.71	96.20	123.30	1.58 6.64	0.36
LR1st Molar	107.29	6.96	97.20	131.90	106.25	7.23	84.70	118.50	1.04 7.01	0.57
Md Width	33.38	2.48	29.80	39.10	32.26	3.13	27.10	37.90	1.12 2.83	0.13
Mx Width	27.14	2.29	22.10	31.90	25.79	2.11	19.80	28.70	1.35 2.20	0.02
Trans Disc	6.24	2.98	0.60	13.80	6.47	3.78	-0.80	13.10	-0.23 3.42	0.80

Pearson Correlation Coefficients

	Age (years)	Lower Left 1st Molar	Lower Right 1st Molar	Mandibular Width	Maxillary Width	Transverse Discrepency
Age (years)		0.09440 0.4731	-0.09558 0.4676	-0.02186 0.8684	0.03980 0.7627	-0.04532 0.731
Lower Left 1st Molar	0.09440 0.4731		0.71721 <.0001	0.50630 <.0001	-0.04171 0.7517	0.45607 0.0003
Lower Right 1st Molar	-0.09558 0.4676	0.71721 <.0001		0.47341 0.0001	0.02032 0.8775	0.38643 0.0023
Mandibular Width	-0.02186 0.8684	0.50630 <.0001	0.47341 0.0001		0.14857 0.2572	0.74500 <.0001
Maxillary Width	0.03980 0.7627	-0.04171 0.7517	0.02032 0.8775	0.14857 0.2572		-0.54898 <.0001
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Significant correlation between:

- **Lower left** and **right 1st molar angulations**
- **Mandibular width** and the angulation of the **Lower Left 1st Molar**
- **Mandibular width** and the angulation of the **Lower Right 1st Molar**
- Transverse discrepancy and
  - The angulation of the **Lower Left 1st molar**
  - The angulation of the **Lower Right 1st molar**
  - **Mandibular Width**
  - **Maxillary Width**

Linear Regression Analysis

Dependent Variable: Transverse Discrepancy

Independent Variable	Beta Estimate	Standard Error	P-Value
Lower Left 1st Molar	0.24	0.06	0.0002
Gender	0.64	0.80	0.4273
Age (years)	-0.31	0.40	0.4293

For every 1 degree of increase in angulation of the Lower Left 1st Molar, the transverse discrepancy increased by a statistically significant amount of 0.24mm.

Linear Regression Analysis

Dependent Variable: Transverse Discrepancy

Independent Variable	Beta Estimate	Standard Error	P-Value
Lower Right 1st Molar	0.19	0.06	0.0026
Gender	0.42	0.83	0.6116
Age (years)	-0.04	0.41	0.9317

For every 1 degree of increase in angulation of the Lower Right 1st Molar, the transverse discrepancy increased by a statistically significant amount of 0.19mm.

Results – Phase II

Currently Pending
Statistical Analysis

Conclusions:

It is possible to determine the degree of skeletal discrepancy between the maxilla and mandible from the measurement of the angulation of the mandibular first molars measured from the long axis of the molar.

Phase II [Data currently in analysis]: Is it possible to determine the degree of skeletal discrepancy between the maxilla and mandible from the measurement of the buccal surface of the lower first molar?

Thank you!

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