Reader's Forum

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READER'S FORUM

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Covariance patterns between ramus morphology and the rest of the face: A geometric morphometric study.

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I read the paper titled "Covariance patterns between ramus morphology and the rest of the face: A geometric morphometric study" by Krüsi et al.[1] with much interest, and I have some comments and concerns that might help. Primarily, no hypothesis is tested in this study and the descriptive findings regarding the ramus are limited to statistical shape-space. For example, the authors did not mention the coronoid process and the angle of the mandible in their narrative, both of which are dependent on muscle development. On the other hand, they also omitted the epigenetic potential of condylar stem cells[2] and cranial base orthocephalization,[3] both of which play significant roles in determining clinical mandibular morphology and spatial orientation. In effect, the ramus width might simply be a by-product of other proactive developmental processes; perhaps the developmental ontogeny of the mandible described in this article is based on, some might say, outdated concepts. For example, the functional matrix hypothesis was left unfinished,[4] but later Singh[5] was able to integrate genetics[6] and epigenetics[7] to describe mandibular behavior *inter alia*, using the Spatial Matrix Hypothesis, which integrates temporo-spatial patterning[8] to describe developmental compensation and postural (clinical) decompensation.

Another issue with the earlier studies is both the materials and the methods that were available at that time. For example, Enlow and Hans[9] used cephalographic data, and while the authors recognize the deficiencies of cephalometric analysis, their validation is based on different reasons. In other words, even though conventional two-dimensional (2D) cephalometric analysis is limited by fixed references planes, homologous landmarks etc., the main issue with this data is that it compresses a three-dimensional (3D) object unto a 2D image, which does not accurately reflect the subject of study in real space. Consequently, the ramus widths derived in this study may not reflect clinical reality. The reader is left wondering why 3D data, which is now more readily available, was not used in this study. In addition, while the methods used in this present study appear useful, they lack graphical outputs that earlier geometric morphometric studies successfully deployed on mandibular allometry several years ago.[10] This omission represents both a deficiency in literature review and is a less useful presentation for clinical orthodontists. Finally, it is well known that mandible exhibits heterogeneity, based on factors such as cranial base morphology and ethnicity[11] *inter alia*. Thus, by not discretizing into the various mandibular classes, the results of the present study might represent a sophisticated academic exercise, which appears to have reduced utility in clinical orthodontics. In any case, I encourage the authors to pursue their endeavor so that ramus widths, etc. can be used for modern diagnostic and treatment planning procedures as well as predictive orthodontic modeling.

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We thank Dr. Singh for his insightful comments and for his interest in our work. The topic of mandibular growth, and its control by genetics, epigenetics and function, has a long history and is still under extensive investigation by the orthodontic community. It is therefore understandable that we could not cover it comprehensively, but presented only selected aspects relevant to our specific research question. We thank Dr. Singh for providing additional information from his own scientific work to the readers of the journal.

Regarding the use of 3D data, we fully agree that this would have been ideal. However, such data were not available due to radiation concerns, obliging us to use conventional cephalometric records that have driven most orthodontic research. We presented our results using contemporary visualization methods of geometric morphometrics, such as scatter plots in shape-space and extremes of variability patterns. The latter looks similar to a cephalometric tracing and is familiar to orthodontists. Of course, numerous alternatives exist, some not being in vogue, others of no clear advantage. Finally, subdividing the sample into discreet and arbitrary classes was in contrast to our methodology, as we were interested in evaluating co-variation patterns over the whole and continuous spectrum of shape variability.

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References

1. Krüsi M, Halazonetis DJ, Eliades T, Koretsi V. Covariance patterns between ramus morphology and the rest of the face: a geometric morphometric study. Korean J Orthod 2023;53:185-93. https://doi.org/10.4041/kjod22.208
2. Santiago PE, Singh GD, Yáñez MA, Dietrich RA, García P, Grayson BH, et al. Restitution of the temporomandibular joint in patients with craniofacial microsomia after multiplanar mandibular distraction: assessment by magnetic resonance imaging. Semin Orthod 2011;17:186-96. https://doi.org/10.1053/j.sodo.2011.02.003
3. Singh GD, McNamara JA Jr, Lozanoff S. Morphometry of the cranial base in subjects with Class III malocclusion. J Dent Res 1997;76:694-703. https://doi.org/10.1177/00220345970760021101
4. Moss ML. The functional matrix hypothesis revisited. 4. The epigenetic antithesis and the resolving synthesis. Am J Orthod Dentofacial Orthop 1997;112:410-7. https://doi.org/10.1016/s0889-5406(97)70049-0
5. Singh GD. On growth and treatment: the spatial matrix hypothesis. In: McNamara JA Jr., ed. Growth and treatment: a meeting of the minds. Ann Arbor: University of Michigan; 2004. p. 197-239.
6. Singh GD, Hay AD. Morphometry of the mandible in prepubertal craniofacial microsomia patients following an inverted L osteotomy. Int J Adult Orthodon Orthognath Surg 1999;14:229-35. https://pubmed.ncbi.nlm.nih.gov/10686847/
7. Singh GD, Clark WJ. Localization of mandibular changes in patients with class II division 1 malocclusions treated with twin-block appliances: finite element scaling analysis. Am J Orthod Dentofacial Orthop 2001;119:419-25. https://doi.org/10.1067/mod.2001.113265
8. Chaplain MAJ, Singh G, McLachlan JC. On growth and form: spatio-temporal pattern formation in biology. New York: John Wiley and Sons; 1999.
9. Enlow DH, Hans MG. Essentials of facial growth. Philadelphia: Saunders; 1996.
10. Singh GD, McNamara JA Jr, Lozanoff S. Mandibular morphology in subjects with Class III malocclusions: finite-element morphometry. Angle Orthod 1998;68:409-18. https://pubmed.ncbi.nlm.nih.gov/9770098/
11. Singh GD, McNamara JA Jr, Lozanoff S. Comparison of mandibular morphology in Korean and European-American children with Class III malocclusions using finite-element morphometry. J Orthod 2000;27:135-42. https://doi.org/10.1093/ortho/27.2.135