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Surface area congruence of atlas superior articulating facets and occipital condyles

To the Editor:

It is encouraging to see new, clinically relevant upper cervical anatomical research; and no Blair practitioner will be surprised by the findings of Briggs et al¹ of bilateral asymmetry of the atlantooccipital (AO) articulations. However, several of the references of Briggs et al to Blair's hypothesis on the matching of ipsilateral AO surfaces, his research database, and his radiographic analysis require clarification.

Blair² does state broadly that "the articulations of the body perfectly match at the articular surfaces"; but he subsequently restricts his consideration to the³ "comparison of articular surfaces at their margins," advancing no specific hypothesis as to surface areas. Finding that the medial margins of the AO articulations are "seldom well-defined" and "do not offer us articular surface comparison," he developed the Blair Oblique Protractoviews specifically to image the most anterolateral or "distal condyle lateral mass margins" parallel to the longitudinal axis of each articulation.⁴ Viewing even these distal margins at too posterior⁴ or too anterior⁵ a point can be misleading as to articular alignment.

Blair's research was based not on "matched and unmatched" cadaver specimens with cartilage attached, but primarily on hard tissue "stereoscopic [i.e., three-dimensional] study of hundreds of Cranial-Atlanto-Axial-Cervical spinographs" (precision postural radiograph meeting chiropractic standards)² and on malformation data from "anatomical measurement" of dry specimens in the BJ Palmer Osteological

Collection supplied by Dr LG Fraser.⁴ Thus, the findings of Briggs et al are essentially peripheral to Blair's assertions, which invariably refer to osseous, not soft tissue, margins. Nevertheless, several potential sources of investigational error should be noted.

The cleaning itself, however meticulous, of the acute distal edges of lateral mass vs the obtuse (and often very short and indistinct) distal edges of the condyle presents 2 distinct psychomotor challenges to the hand. Any potential systematic error thus introduced would be compounded for methods 2 and 3 of Briggs et al by the "cut[ting] out," by unspecified but presumably equally vulnerable means, of the aluminum foil molds.

For all 3 methods of Briggs et al, the outlines obtained will indeed depend, as the authors suggest, on the exact angle at which the mold or anatomical material is mounted with respect to the projectional surface. However, this is not a "minor measurement flaw" but a major source of potential error that must be carefully controlled in clinical practice.^{4,5} Consistent measurement is not necessarily correct measurement.

Briggs et al state that their method 3 is the most relevant because it mimics what is seen on the Blair Protractoviews.¹ Their method looks at the image mimicking a base posterior or vertex radiograph (a coronal view). Blair insisted that the relationships of the condylar and lateral mass distal margins should not be assessed from the coronal view at all, but from a diagonally vertical perspective and "on a plane 90° to the [slope of the] articulation."⁴ Therefore, the conclusion of Briggs et al comments on radiographic images that they did not study in their article.

A more technical exposition of Blair's hypotheses, observations, and methods as related to the procedures of Briggs et al is available at www.blairchiropractic.com. Hopefully, such studies as that of Briggs et al will stimulate further investigation into this pivotal area of the spine.

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Reply

In reply:

We appreciate the responder's interest in our study. Our study was not intended to show flaws in any particular radiographic technique. All techniques that use an overlap/under lap approach to assess the atlantooccipital (A-O) articular misalignment are susceptible to inherent measurement flaws due to structural asymmetries. The reader was informed that the procedures used in our study did not directly transfer to real-life radiographic measurements but were used to show that there can be an inherent asymmetry that may lead to false positives or false negatives (ie, existence of misalignments when there are none or apparent aligned vertebrae that are actually misaligned).¹

We would first like to point out that the references provided to support the Blair theory in the responder's letter are opinion papers, based on observations of bony specimens, rather than quantitative research on bony specimens as we have done in our study.¹⁻³

One reason for not using a view that mimicked the Blair protractor view in our research for assessing how well the A-O margins line up is because the Blair protractor-type view assesses only part of the A-O margin, that is, the anterolateral aspect, leaving other

parts (ie, the medial margins) of the joint unanalyzed. This is no small shortcoming because the spinal cord would be affected by medial A-O margins, not lateral A-O margins.

Regarding the concern about the possibility that cartilage was left on the bone in our study, the soft tissue around the outer portion of the bone, including the fibrous joint capsule, was removed. The articular surfaces of both the atlas and the occipital condyle were exposed. These surfaces are protected by a smooth thin layer of hyaline cartilage that is in intimate contact with the underlying bone. It is likely that, if the hyaline cartilage layer was removed, it would have created distortion of the joint surfaces and would have rendered the surfaces unusable for measurement. Care was taken to evaluate the joint surfaces for natural distortion of the joint surface (ie, osteoarthritis). To disturb the surface hyaline cartilage would create a pseudodegenerative joint condition. The soft tissue (ie, cartilage, ligaments, muscle) remains present on a radiograph even if not observed directly, so it is prudent from a research prospective that areas of measurement be as close to real life as possible. Overlap/under lap of the A-O joint surface may or may not contain a substantial amount of soft tissue (ie, hyaline cartilage). To answer this question requires further study.

Again, we appreciate the responder's interest in our study.

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