Head's Center of Gravity Shifted in Chiari Patients

An object's center of gravity is an imaginary point where the distribution of the mass of the object is in balance relative to gravity. In people the head's center of gravity is located slightly forward from the supporting spine which means that the muscles in the back of the neck must work to keep the head upright. This is why your head falls forward if you fall asleep while sitting in a chair.

A recent study from Turkey which used x-rays to compare 102 surgical Chiari patients to healthy volunteers found that in Chiari patients the head's center of gravity was shifted significantly forward and that the head tended to be flexed down with the chin towards the chest. To determine this, the researchers identified seven reference points on the x-rays which are common anatomical landmarks. They then used these reference points to calculate seven different angles.

They found significant differences between the Chiari patients and the volunteers in five of these angles. The differences suggested that the center of gravity was shifted forward with Chiari and that the head position was in flexion (chin down). With the head shifted forward and down, the stabilizing muscles in the back of the neck must do extra work to keep the head upright. However, as also reported in this month's research updates, those specific muscles don't work as well in Chiari patients. While not studied directly in Chiari patients, this type of forward head shift and tilt is thought in general to cause headaches and dizziness.

The researchers also looked at how well these angle measurements could differentiate the Chiari patients from the volunteers. They found that based just on one or two of the measurements the participants could be accurately identified as Chiari or volunteer about 75% of the time.

One thing the authors did not discuss is whether the strength of the stabilizing muscles are negatively impacted by the Chiari surgery itself and how this might impact the ability of patients to maintain proper head posture.

Source: Karadeniz R, Dağlar Z, Çağıl E, et al. The head position and cervical alignment in patients with Chiari malformation: A retrospective case-control study. J Craniovertebr Junction Spine. 2024;15(4):460-466. doi:10.4103/jcvjs.jcvjs_164_24

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