

Upper Cervical Structure; 3 objects; Head, Atlas and Neck combined by 4 Joints.

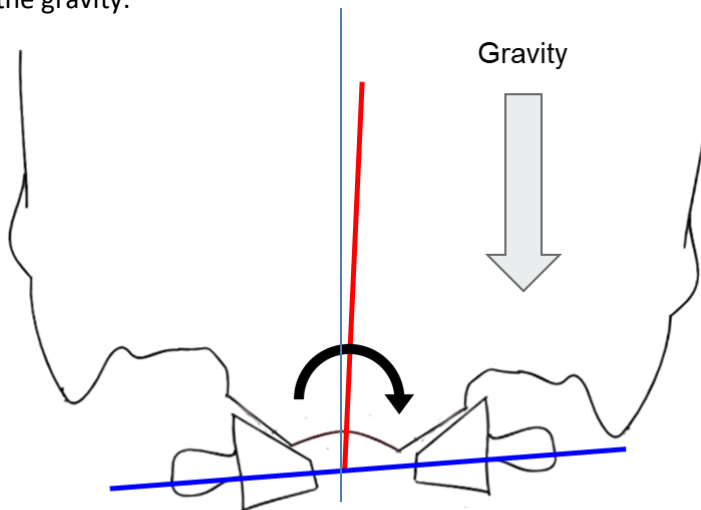
Effort to align these 3 objects in the upper cervical structure to orthogonal position (Proper alignment; Head and Neck in vertical axis and Atlas in horizontal axis) is NUCCA correction.

The resistance in Atlas subluxation is dynamic reaction, not a static misaligned state.

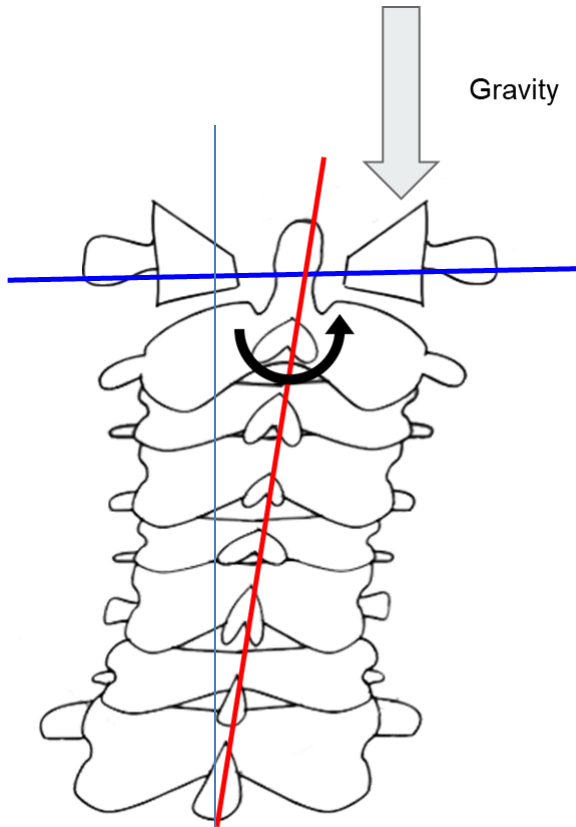
Standard NUCCA analysis is complicated because the calculation uses Laterality and Lower Angle. These angles are the resulting numbers generated from Angular Rotation force and Head Tilt force by gravity. These two factors are contributing as the constant stress force in Atlas joints generated by gravity. If we use these two factors to calculate the correction vector which requires breaking the resistance in the Atlas subluxation, we can determine the adjusting vector without major modification after calculation.

Atlas Subluxation

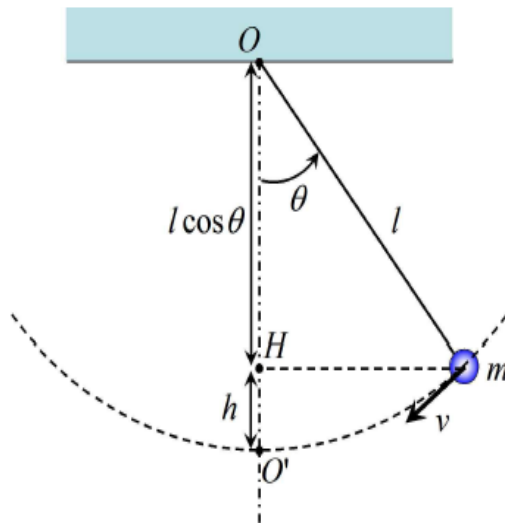
- Skull turning force generates atlas joint resistance proportional to head tilt & condylar circle by the gravity.



- Angular rotation force generates atlas joint resistance proportional to angular rotation & axial circle by the gravity.



- Resistance in Atlas joints' relation to degrees off the vertical axis;



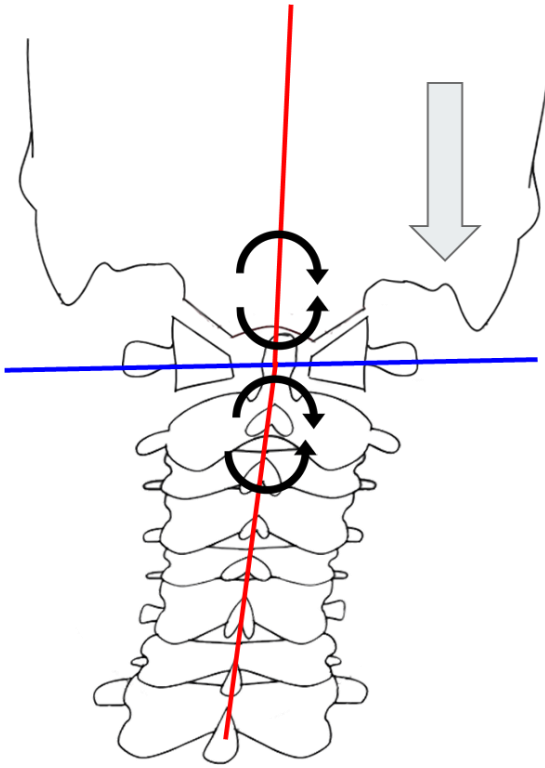
Further from vertical axis, greater force generated by skull or neck

Force or Resistance alters normal neurologic function and feedback: Mechanoreceptors in UC joints

These 2 rotational force interacting each other in the subluxated Atlas joints.

Also these forces are rational to the size of condylar circle and axial circle.

So we can calculate the net force distribution and the vector to correct the Atlas subluxation with this formula.



Resistance is rational to AC and CC, Not depend on the types.

Before the calculation, convert the orientation of misalignment pattern to simple orientation.

For Type 1, rotate the orientation to the orientation which the central skull line is on vertical axis when head is leaning away from side of laterality because head tilt contributes to the subluxation none or very minimal. Convert the 3 elements; plane line, head tilt, and angular rotation.

For Type 2 & Type 3, rotate the orientation to the orientation which the atlas plane line is on horizontal axis because Atlas side slip contributes to the subluxation none or very minimal. Also, head tilt should not be more than laterality. Convert the 3 elements; plane line, head tilt, and angular rotation.

For Type 4, convert it like how we did on type 2 or 3 if HT is more than Atlas Laterality.

Analysis; sum of these 3 factors

1. **Atlas Plane Line;** Add or Subtract 1 inch every 3/16 inch from horizontal line.
2. **Starting Vector;** $C/A = (\frac{1}{2} \text{ of } A-C)$ inches

3. Neck; Angular Rotation and Head Tilt relation in Frontal Plane

Proper relation between Angular Rotation and Head Tilt should be established.

This relation should be based on the resistance distribution created by gravity force of skull. Without the separate calculation of HT and Angles relation, we can calculate them together. Angles are determined by 3 factors; Angular Rotation, Head Tilt and Atlas side Slip.

Instead of using Laterality, Lower Angle and Head Tilt, using Angular Rotation, Head Tilt and Atlas side slip seems more reasonable biomechanically. Atlas side slip was calculated as Atlas plane line. Thus we can figure out the distribution of resistance in 4 facet joints of Atlas. These resistances are generated by gravity force to skull in relation of C/A. Larger size of circle generates more downward resistance. Thus we can make a formula as below.

Formula; $((+/-AR * AC) + (+/-HT * CC)) / (AC * 2)$

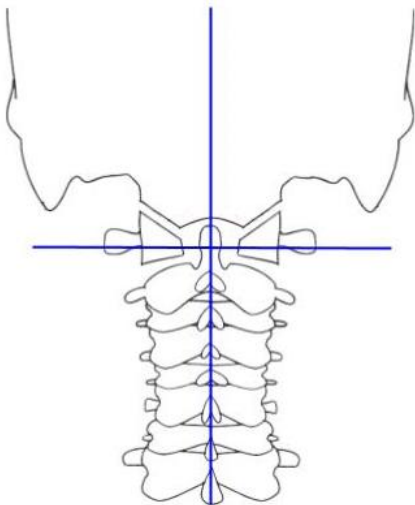
AR; Angular Rotation in degrees; + for AR in same side of Laterality, - for AR in opposite side of Laterality

HT; Head Tilt in degrees; - for HT in same side of Laterality

AC; Axial Circle in numbers

CC; Condylar Circle in numbers

Notes;



C0-C1-C2 has 4 joints. Each joint has a rational resistance resulted by 3 factors; angular rotation, head tilt and atlas sideslip, which determine laterality and lower angle. NUCCA analysis use laterality and lower angle to configure the resistance on these 4 joints.

I believe that using angular rotation and head tilt to configure the resistance on these 4 joints is more logical because these factors are direct source of the resistances and also can be explained in rational distribution.

C/A determines a directional force which affect equal on 2 joints of atlas on the side of laterality.

Using this C/A value, we can find the rational distribution of resistances on 4 joints in upper cervical complex.

Because these joints surface angled, the vertical force

should be considered as resistance in these joints.

Simply, more head tilt and more angular rotation generate more resistance.

Also, larger condylar and axial circle makes more vertical resistance force.

With these factors, the formula can be made as; AR;

$((+/- \text{ head tilt} * \text{condylar circle}) + (+/- \text{ angular rotation} * \text{axial circle})) / \text{axial circle} * 2$

This formula includes the effect of head tilt, eliminate the calculation of head tilt from the vector

calculation.

The vector can be calculated as the sum of PL, C/A and AR.

NUCCA analysis use the sum of PL, AT/OD, C/A and Angles.

Now we need to consider if these factors are true expression of Atlas subluxation or not.

- Head tilt is more than Atlas laterality (head tilt cannot affect more than total subluxation)
- Head is leaning opposite side of laterality (the force generated by head leaning does not contribute to the subluxation)
- In type 2 and 3, PL should not be positive (angular rotation is opposite side)

We want to remove these false factors to the subluxation from vector calculation with converting the misalignment pattern on images.

Examples of the Conversion and calculation of the correction vector

