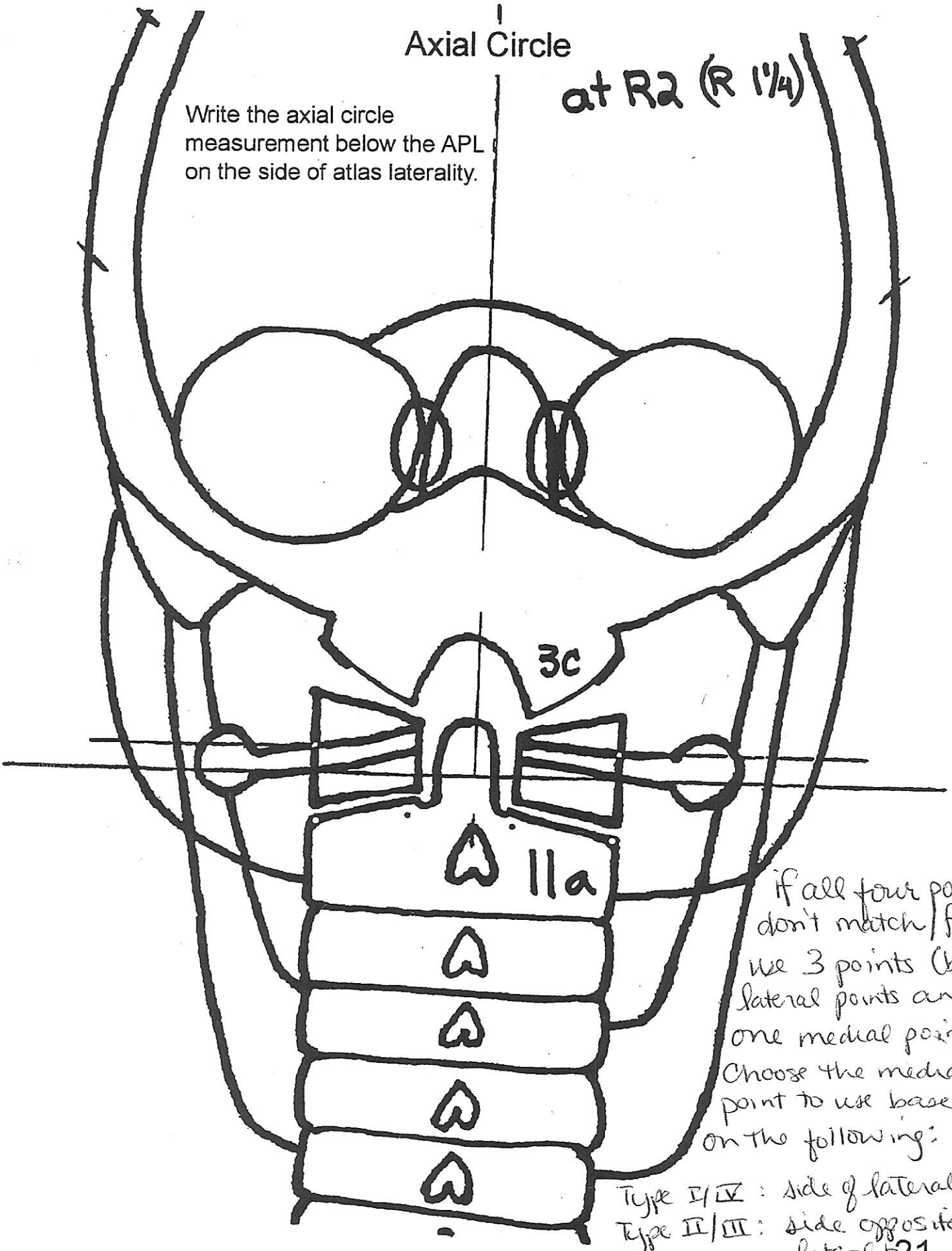
Axial Circle

at R2 (R 1¼)

Write the axial circle measurement below the APL on the side of atlas laterality.



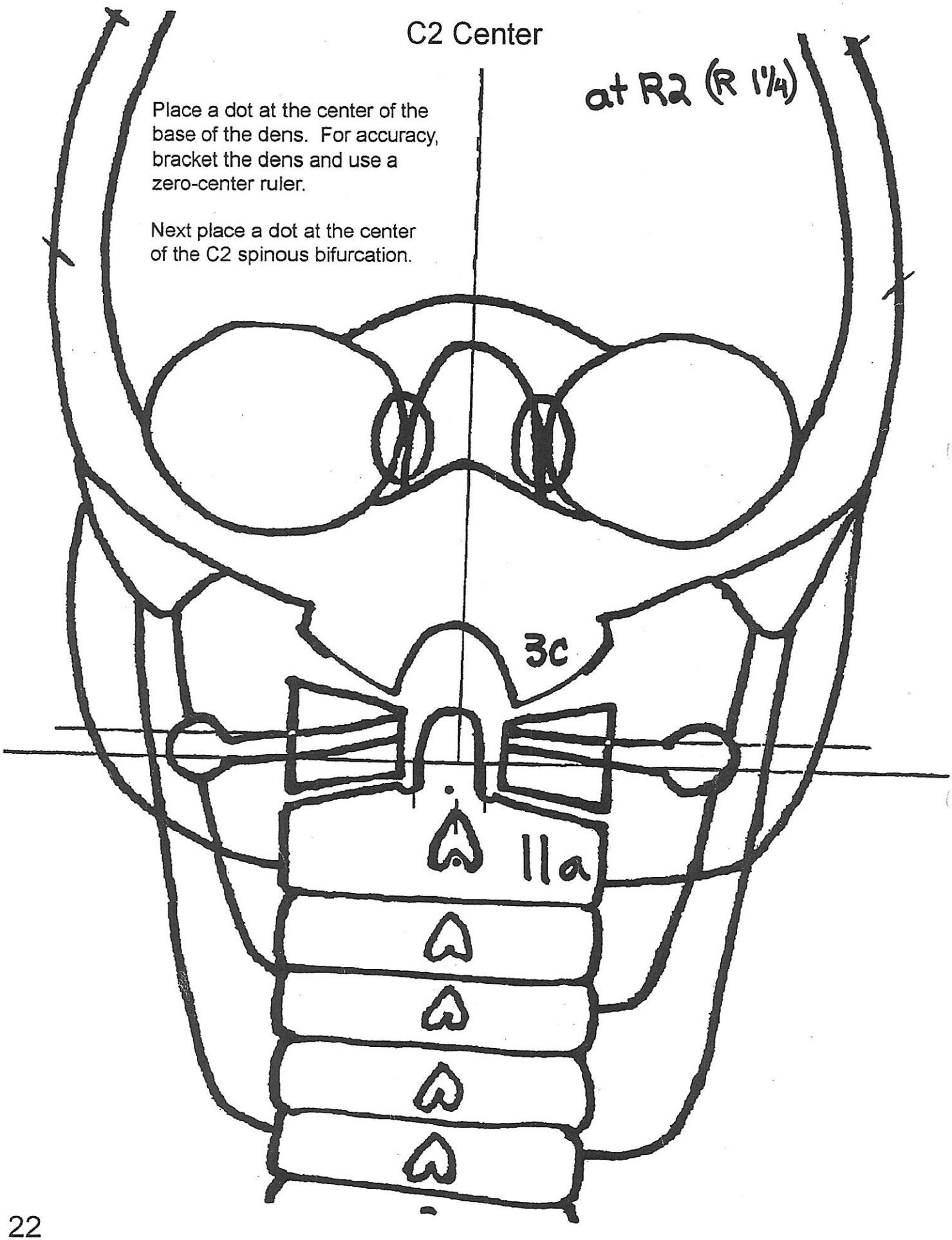
If all four points don't match/fit, use 3 points (both lateral points and one medial point.) Choose the medial point to use based on the following:

Type I/IV : side of laterality
Type II/III : side opposite laterality

C2 Center

Place a dot at the center of the base of the dens. For accuracy, bracket the dens and use a zero-center ruler.

Next place a dot at the center of the C2 spinous bifurcation.

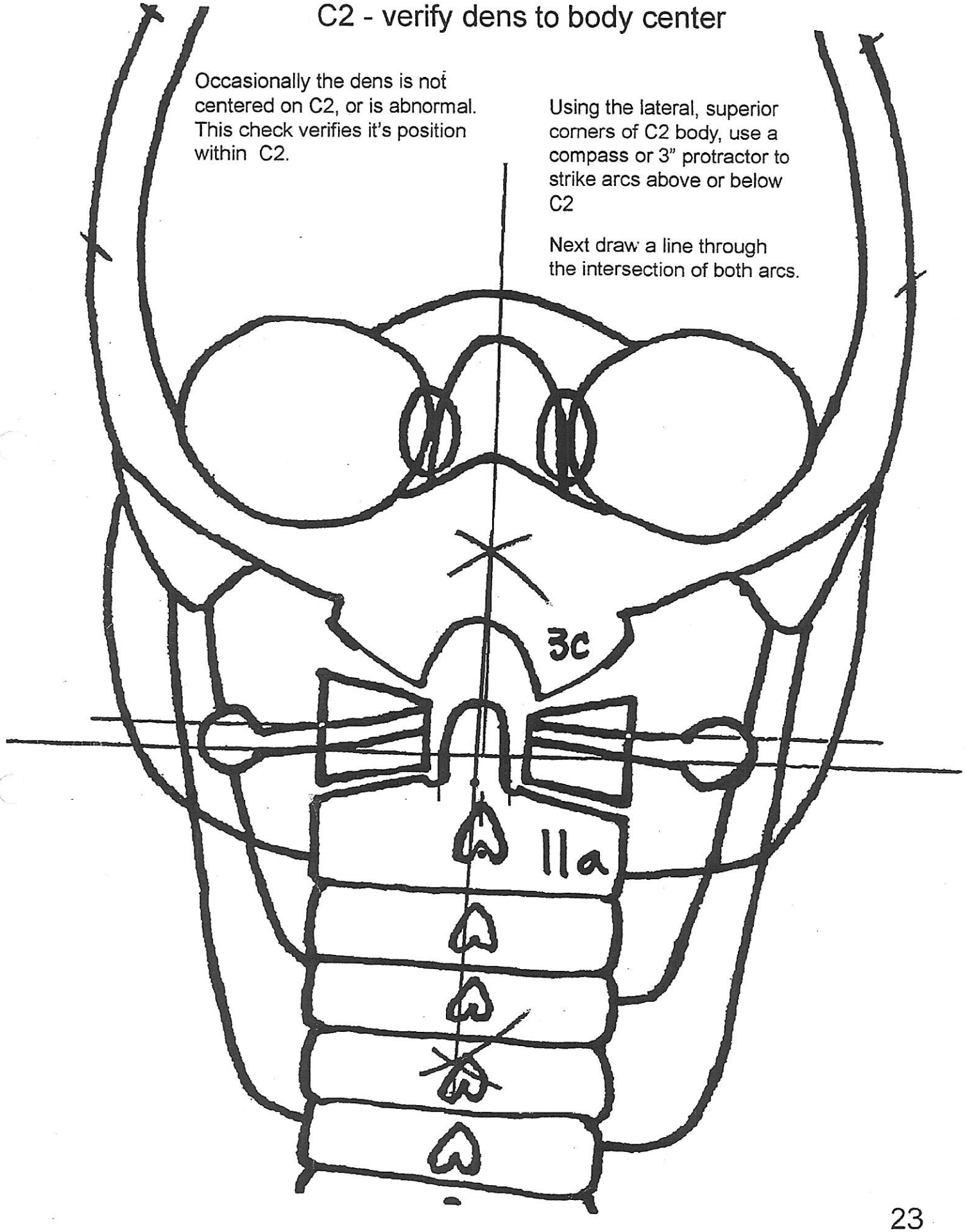


C2 - verify dens to body center

Occasionally the dens is not centered on C2, or is abnormal. This check verifies it's position within C2.

Using the lateral, superior corners of C2 body, use a compass or 3" protractor to strike arcs above or below C2

Next draw a line through the intersection of both arcs.



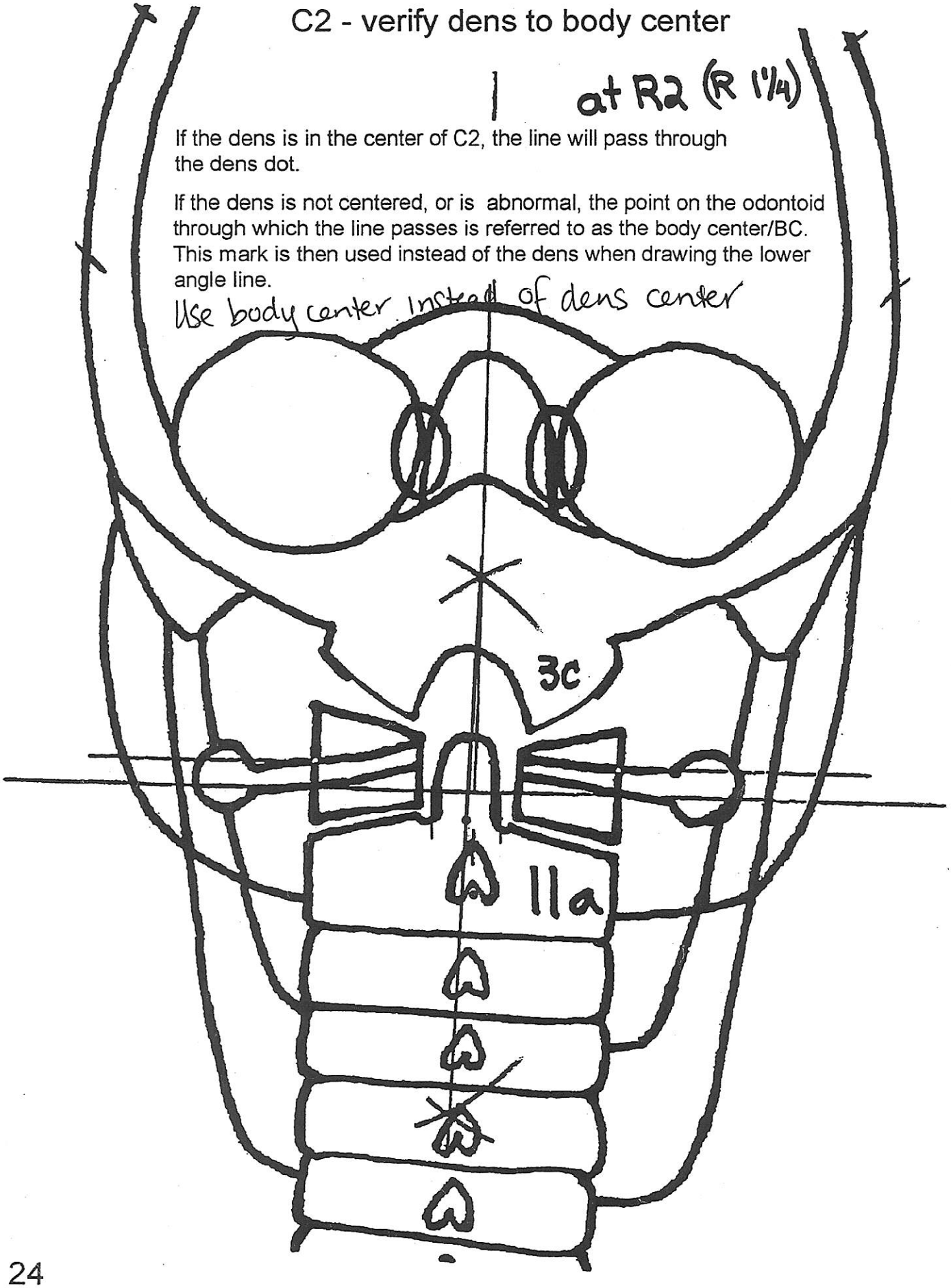
C2 - verify dens to body center

at R2 (R 1¼)

If the dens is in the center of C2, the line will pass through the dens dot.

If the dens is not centered, or is abnormal, the point on the odontoid through which the line passes is referred to as the body center/BC. This mark is then used instead of the dens when drawing the lower angle line.

Use body center instead of dens center

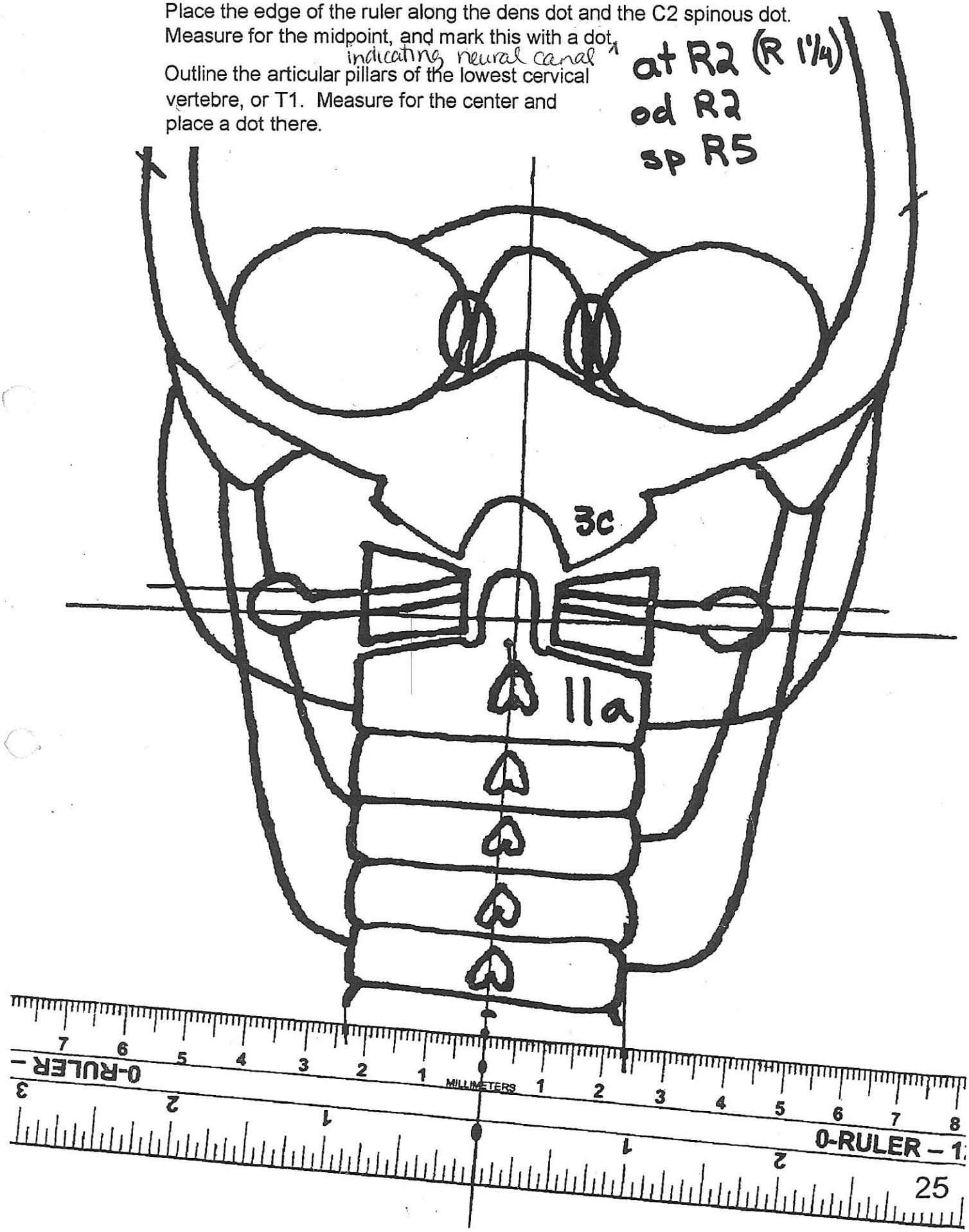


Find Lower Angle

Place the edge of the ruler along the dens dot and the C2 spinous dot. Measure for the midpoint, and mark this with a dot, indicating neural canal

Outline the articular pillars of the lowest cervical vertebre, or T1. Measure for the center and place a dot there.

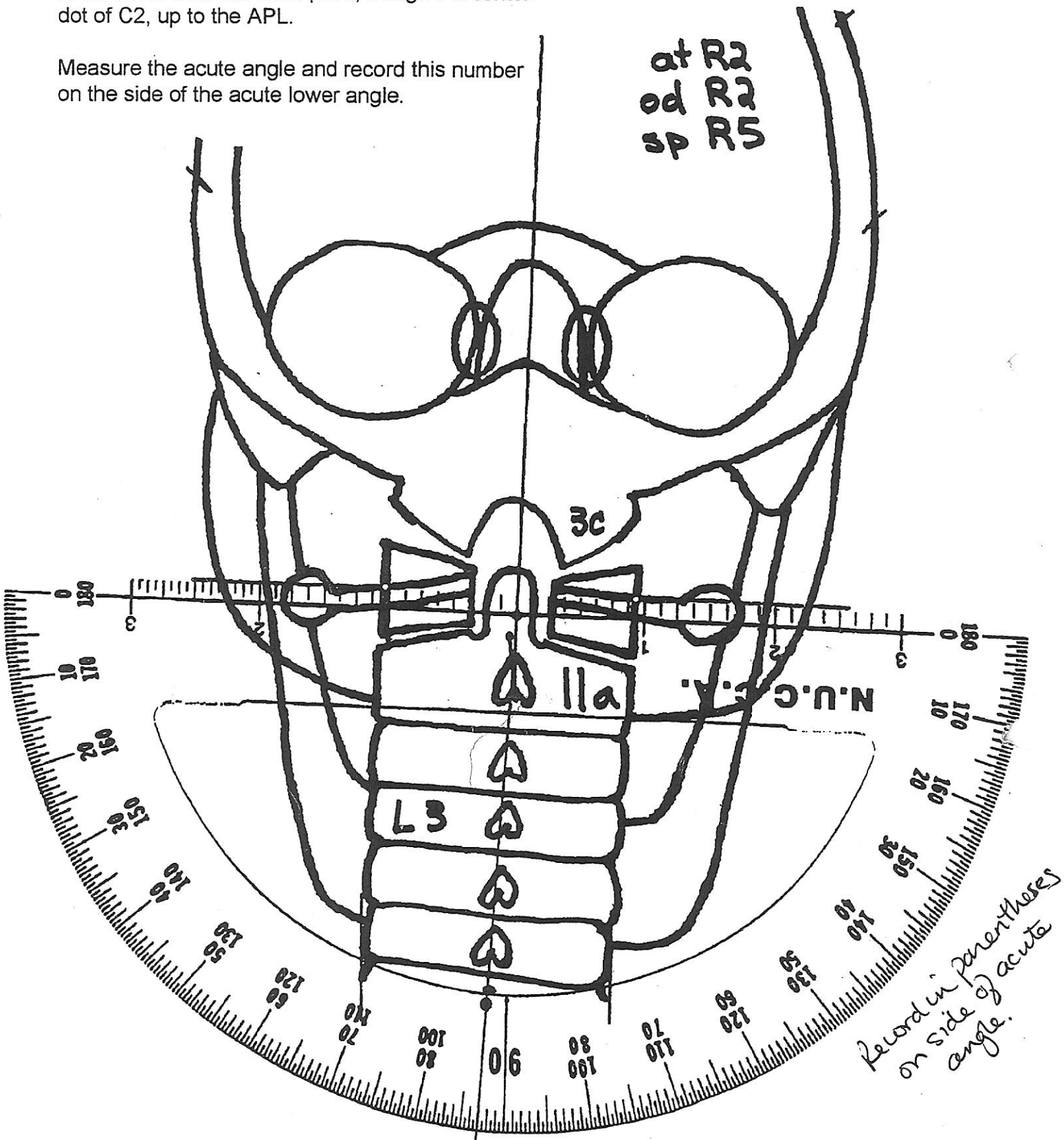
at R2 (R 1¼)
od R2
sp R5



Draw and Measure Lower Angle

Draw a line from the fixed point, throgh the ~~center~~ neural canal dot of C2, up to the APL.

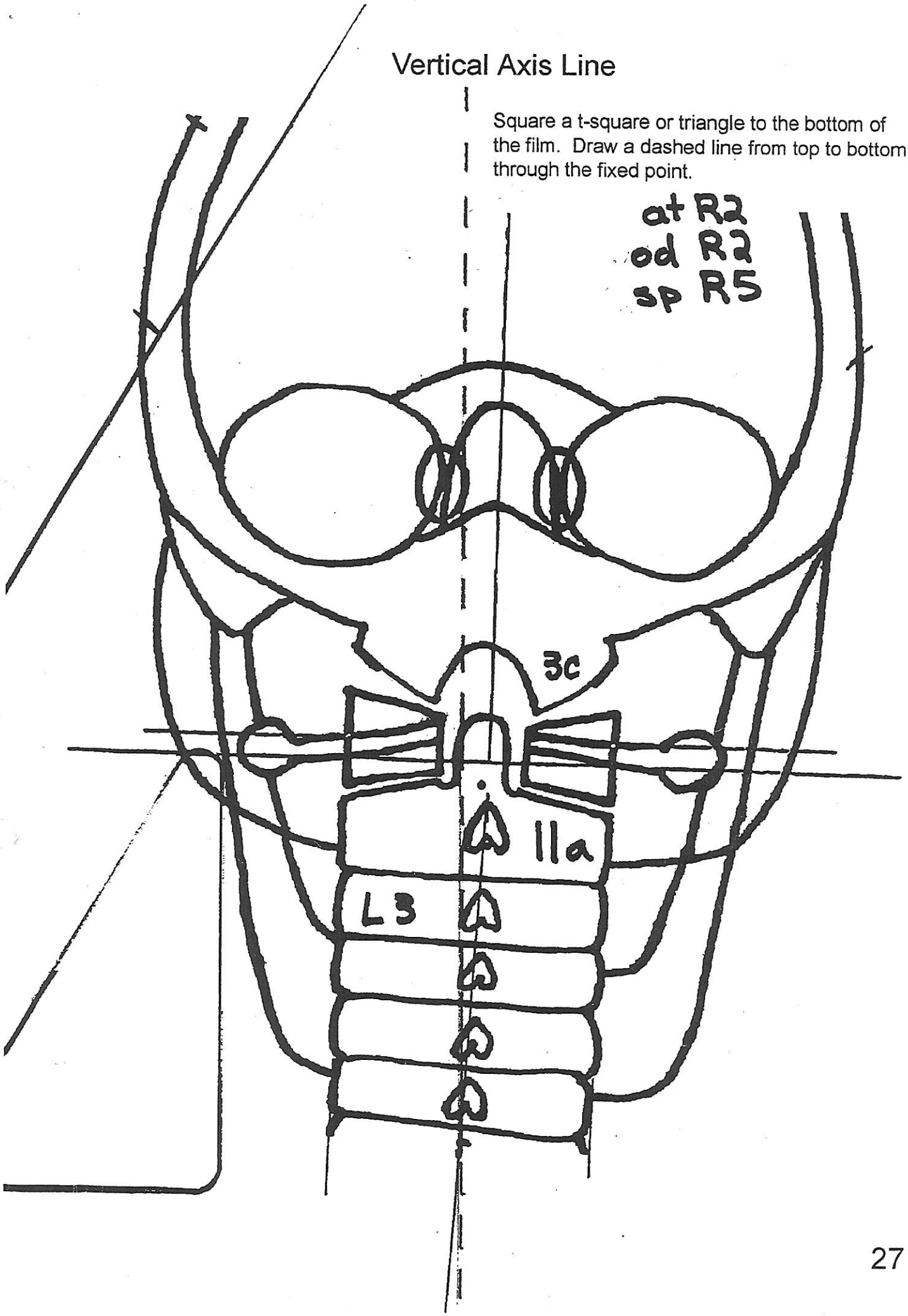
Measure the acute angle and record this number on the side of the acute lower angle.



Also, measure angular rotation by measuring how far the neck has leaned off of vertical. Measure acute angle from

Vertical Axis Line

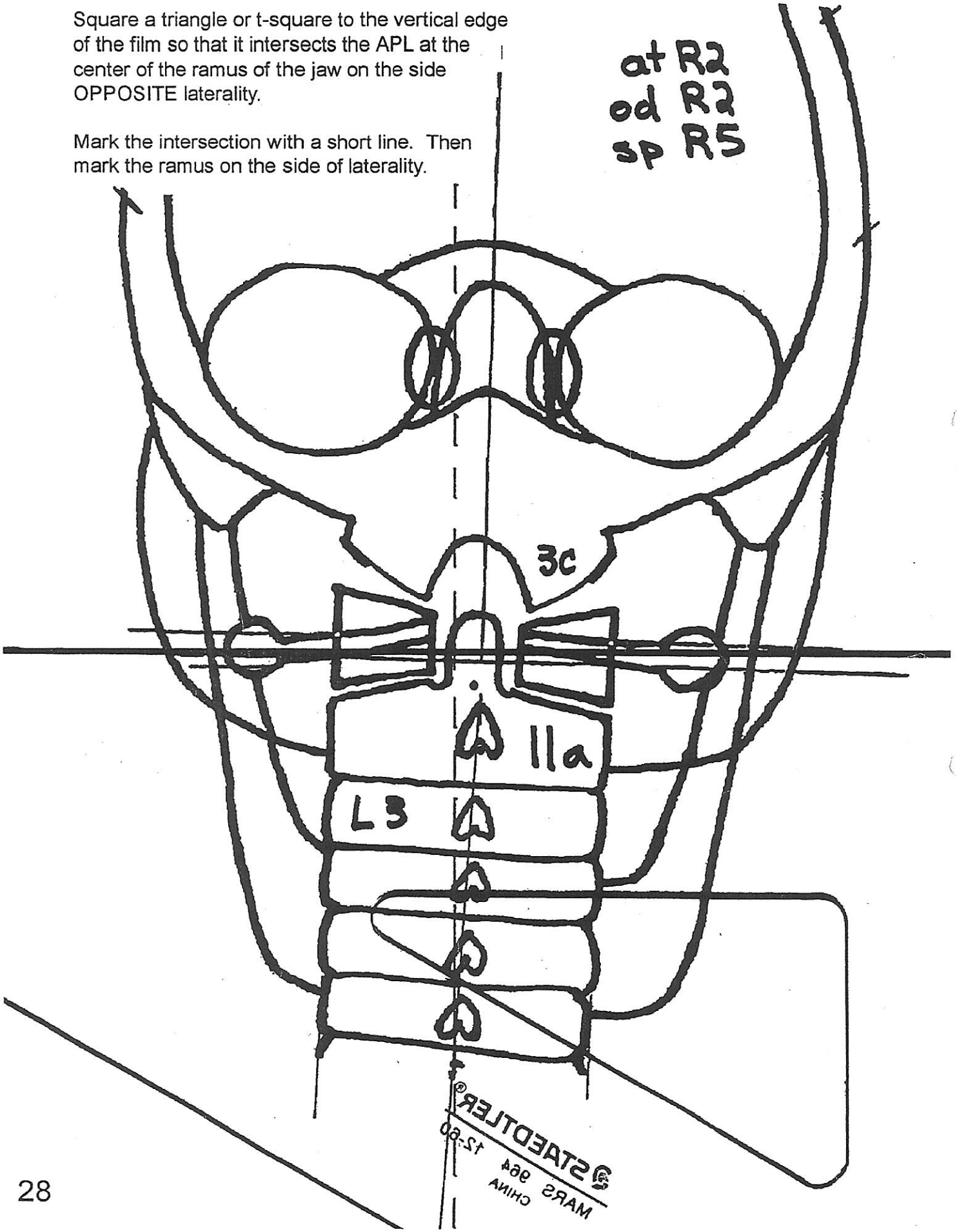
Square a t-square or triangle to the bottom of the film. Draw a dashed line from top to bottom, through the fixed point.



True Horizontal Plane Line

Square a triangle or t-square to the vertical edge of the film so that it intersects the APL at the center of the ramus of the jaw on the side OPPOSITE laterality.

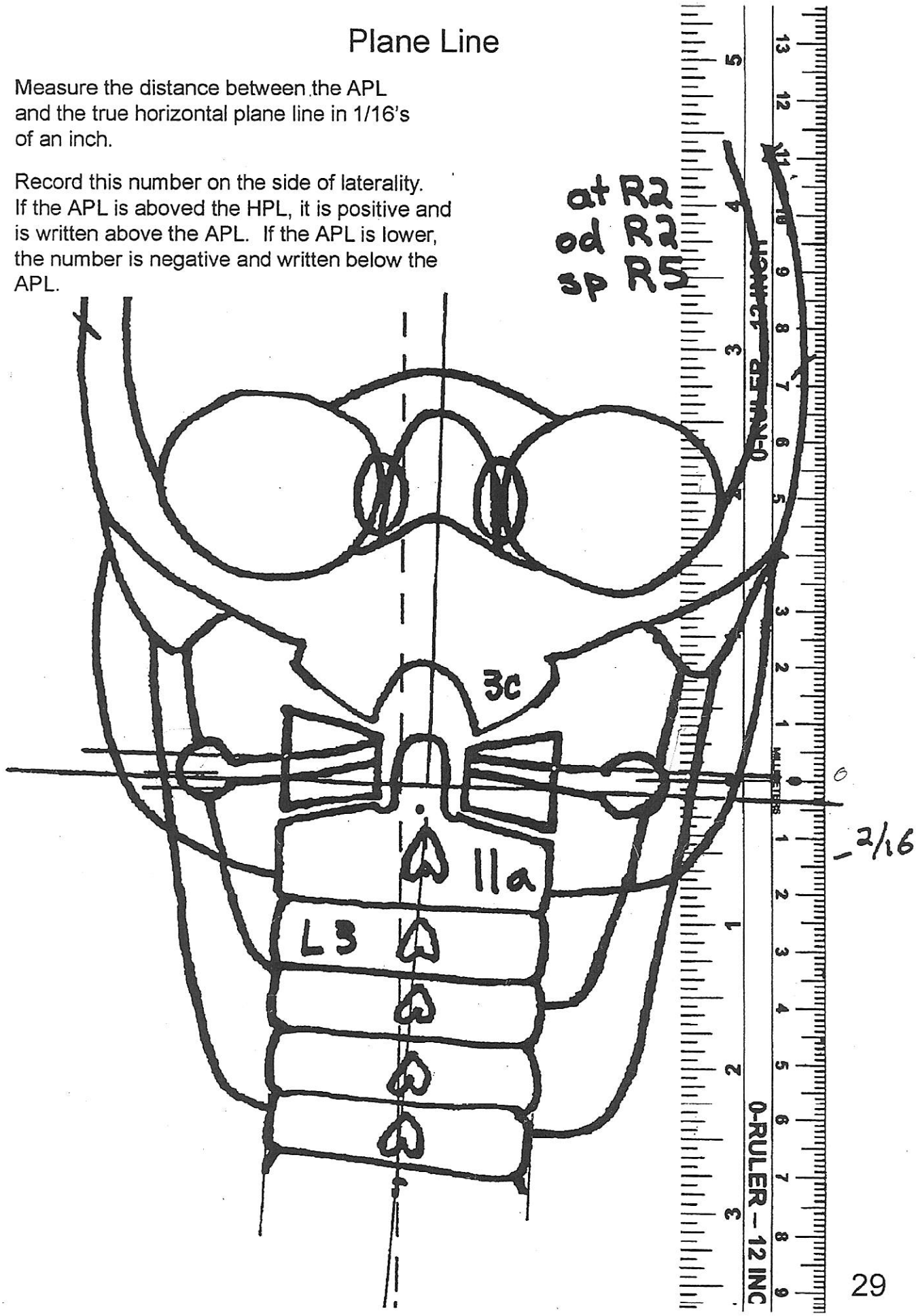
Mark the intersection with a short line. Then mark the ramus on the side of laterality.



Plane Line

Measure the distance between the APL and the true horizontal plane line in 1/16's of an inch.

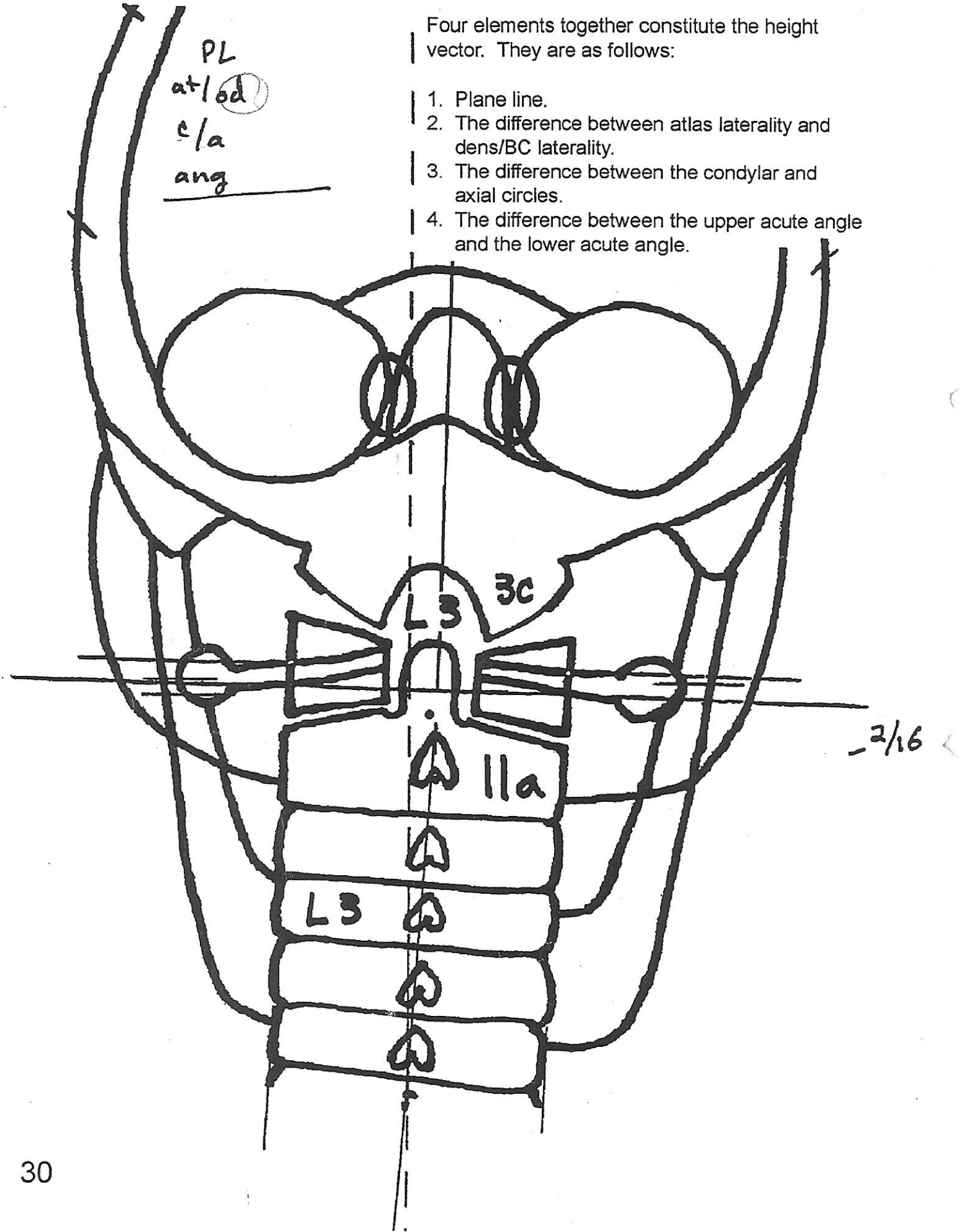
Record this number on the side of laterality. If the APL is aboved the HPL, it is positive and is written above the APL. If the APL is lower, the number is negative and written below the APL.



The Four Elements

Four elements together constitute the height vector. They are as follows:

1. Plane line.
2. The difference between atlas laterality and dens/BC laterality.
3. The difference between the condylar and axial circles.
4. The difference between the upper acute angle and the lower acute angle.

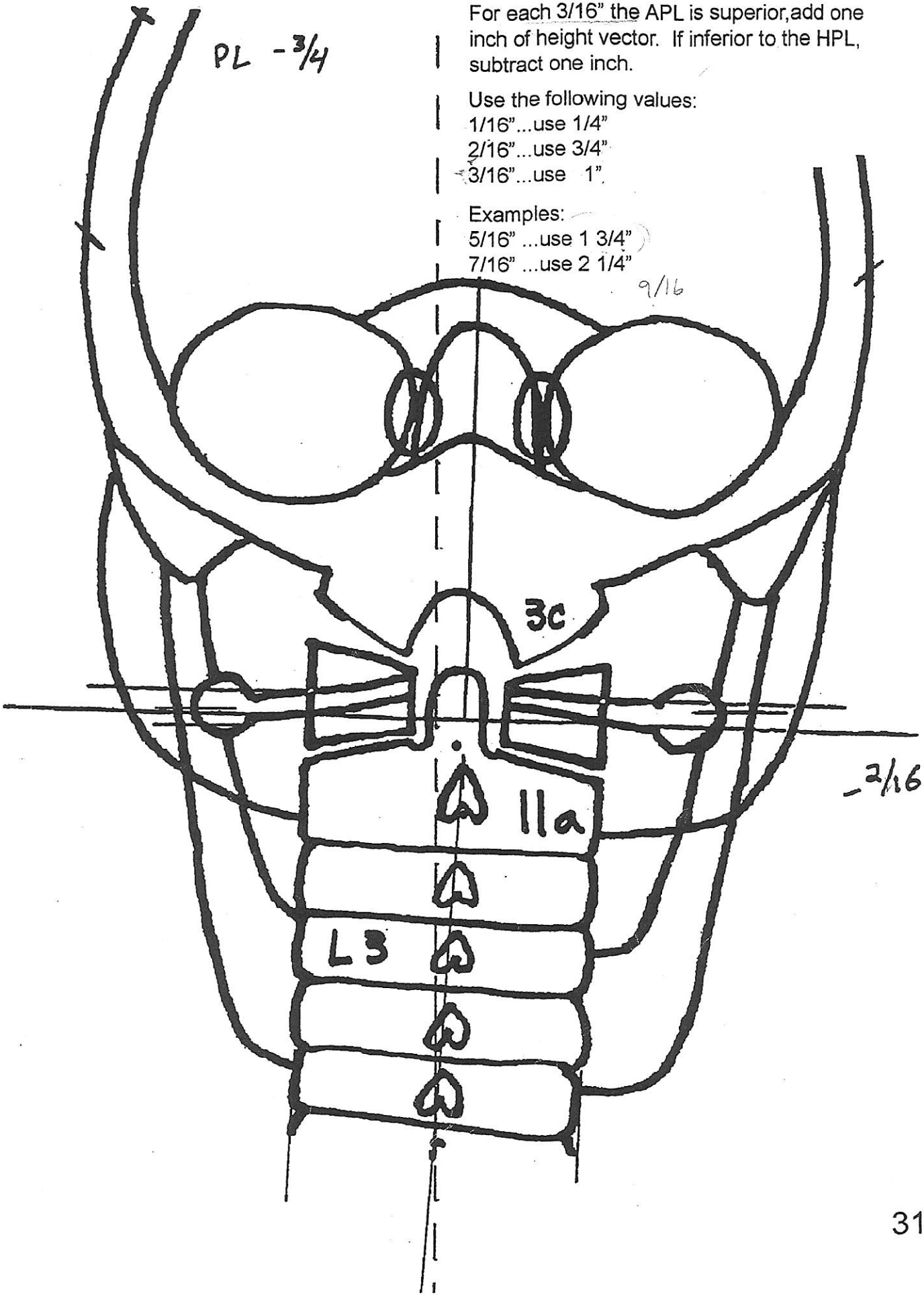


Calculating Plane Line Element

For each 3/16" the APL is superior,add one inch of height vector. If inferior to the HPL, subtract one inch.

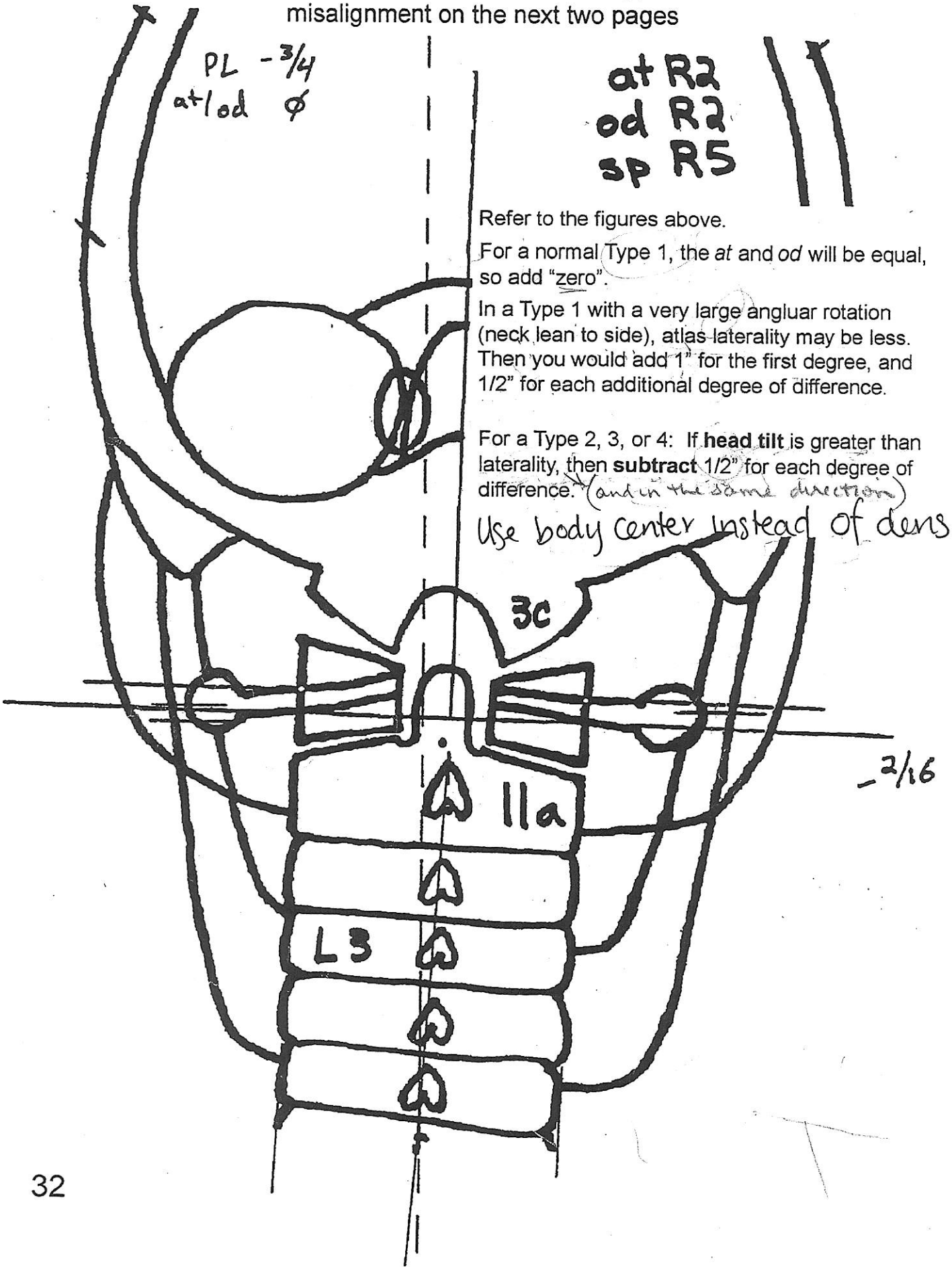
Use the following values:
1/16"...use 1/4"
2/16"...use 3/4"
3/16"...use 1".

Examples:
5/16" ...use 1 3/4"
7/16" ...use 2 1/4"



At/od Element

note: Calculate Dens and C2 Spinous misalignment on the next two pages



Refer to the figures above.

For a normal Type 1, the *at* and *od* will be equal, so add "zero".

In a Type 1 with a very large angluar rotation (neck lean to side), atlas laterality may be less. Then you would add 1" for the first degree, and 1/2" for each additional degree of difference.

For a Type 2, 3, or 4: If **head tilt** is greater than laterality, then **subtract** 1/2" for each degree of difference. (and in the same direction)

Use body center instead of dens

Measure Dens Misalignment

Using the relatoscope scale that best matches the condylar circle measurement, parallel the instrument's horizontal line with the APL. Center it between the outer edges of the lateral masses of atlas

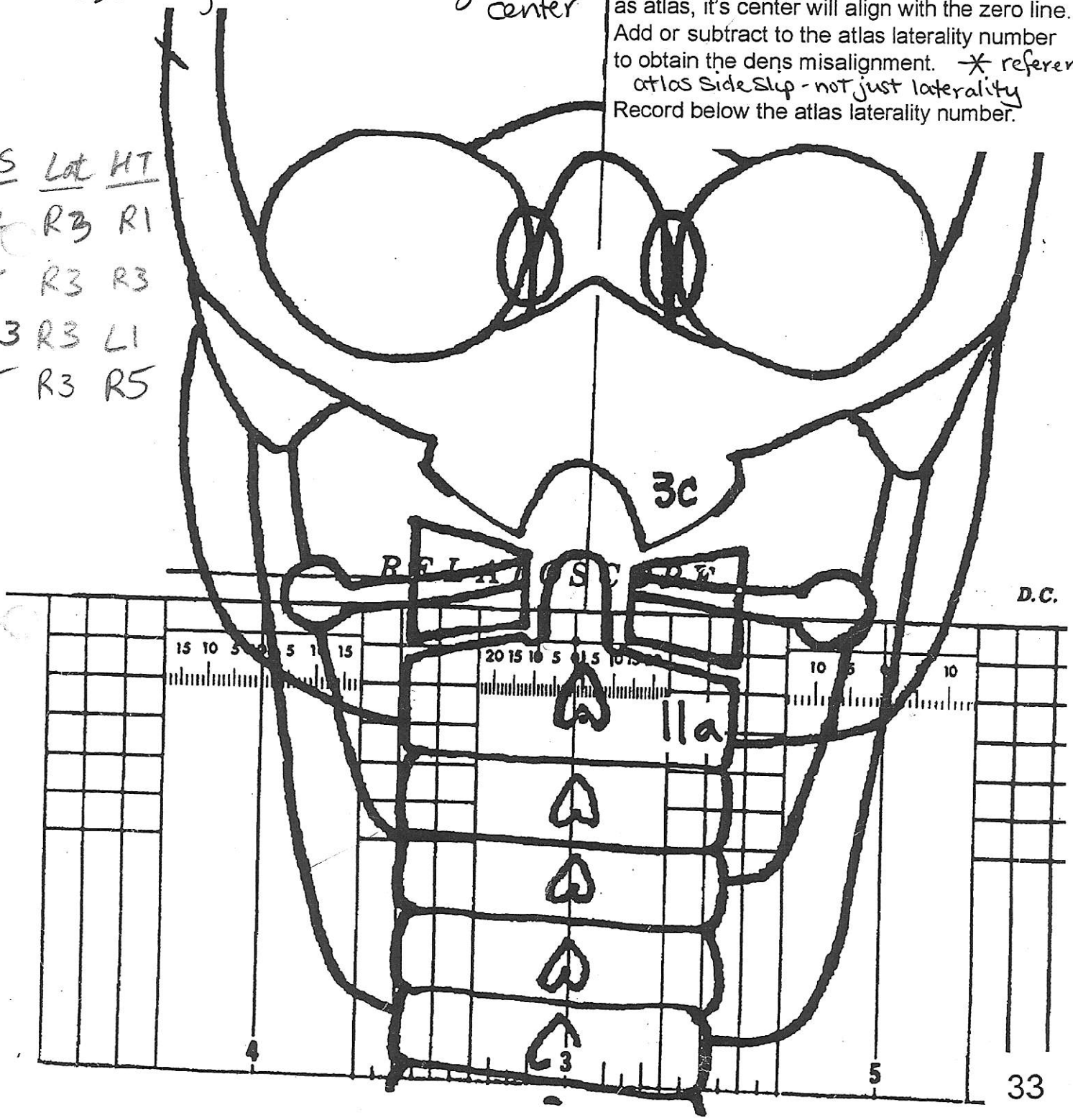
at R2 (R 1¼)
od R2

Use body center instead of dens center

If the dens has subluxated the same amount as atlas, it's center will align with the zero line. Add or subtract to the atlas laterality number to obtain the dens misalignment. * reference atlas Side Slip - not just laterality

Record below the atlas laterality number.

SS	Lat	HT
R2	R3	R1
0	R3	R3
R3	R3	L1
0	R3	R5



C2 Spinous Misalignment

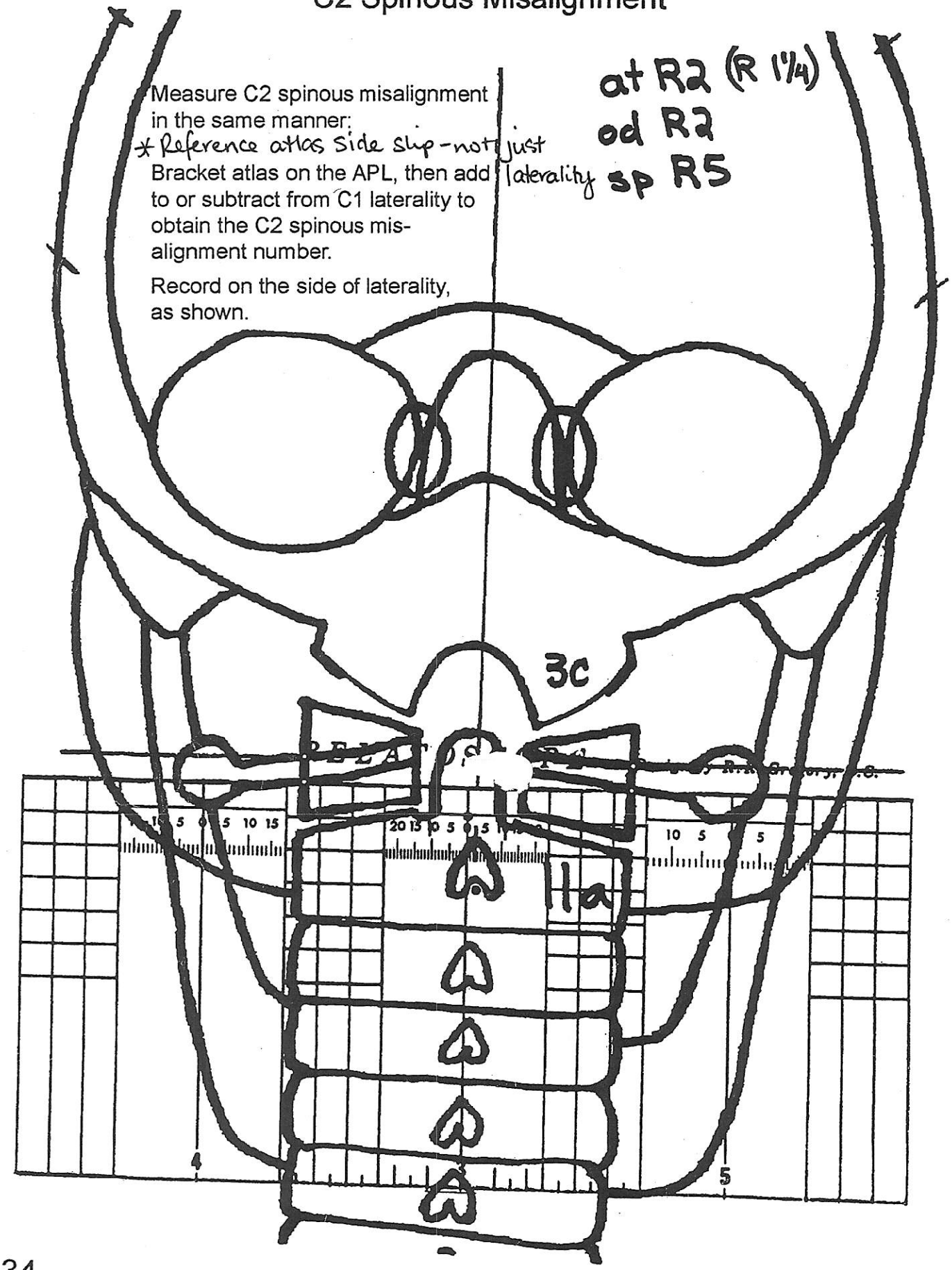
Measure C2 spinous misalignment in the same manner:

* Reference atlas side slip - not just laterality

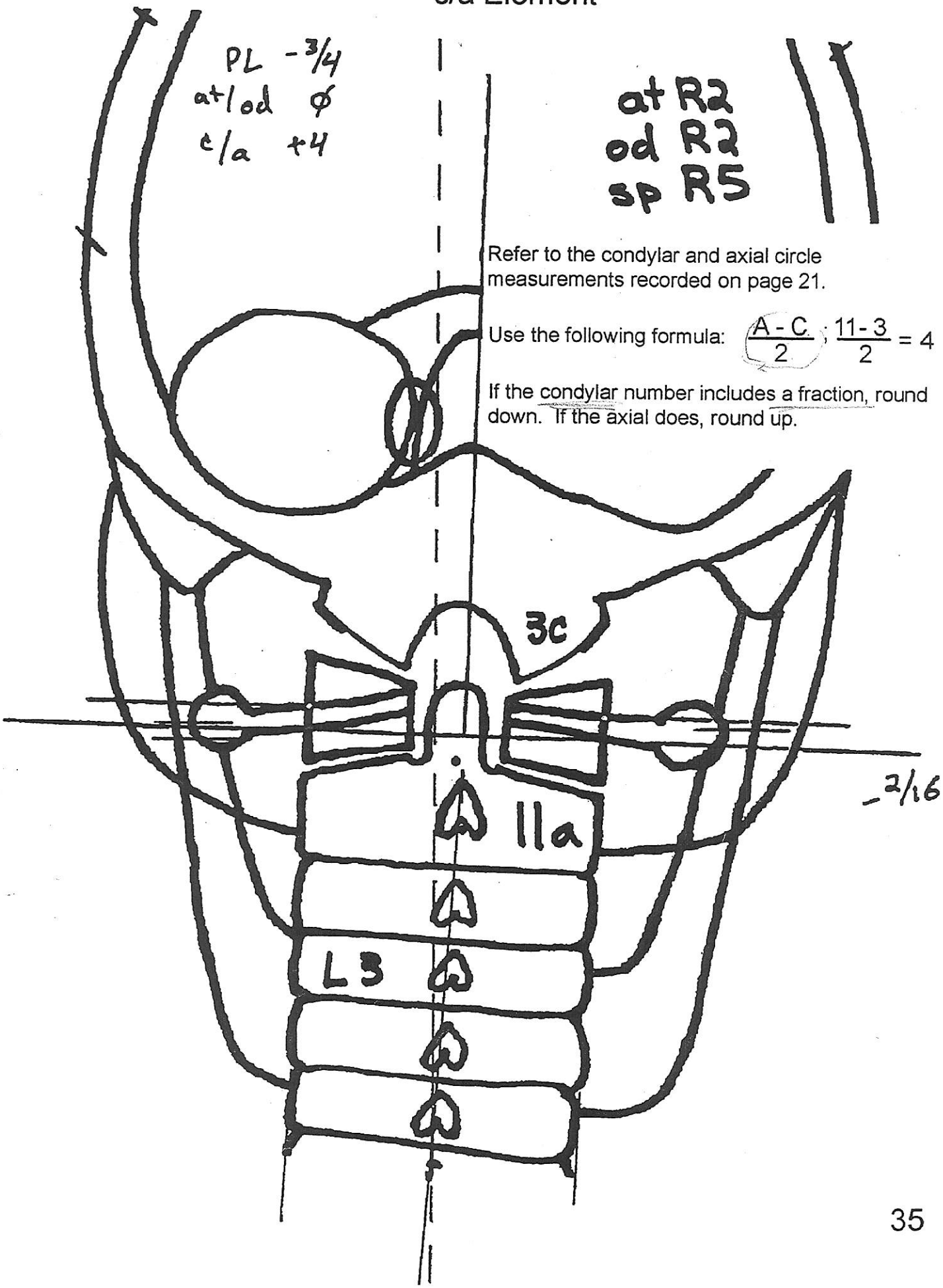
Bracket atlas on the APL, then add to or subtract from C1 laterality to obtain the C2 spinous misalignment number.

Record on the side of laterality, as shown.

at R2 (R 1¼)
od R2
sp R5



c/a Element

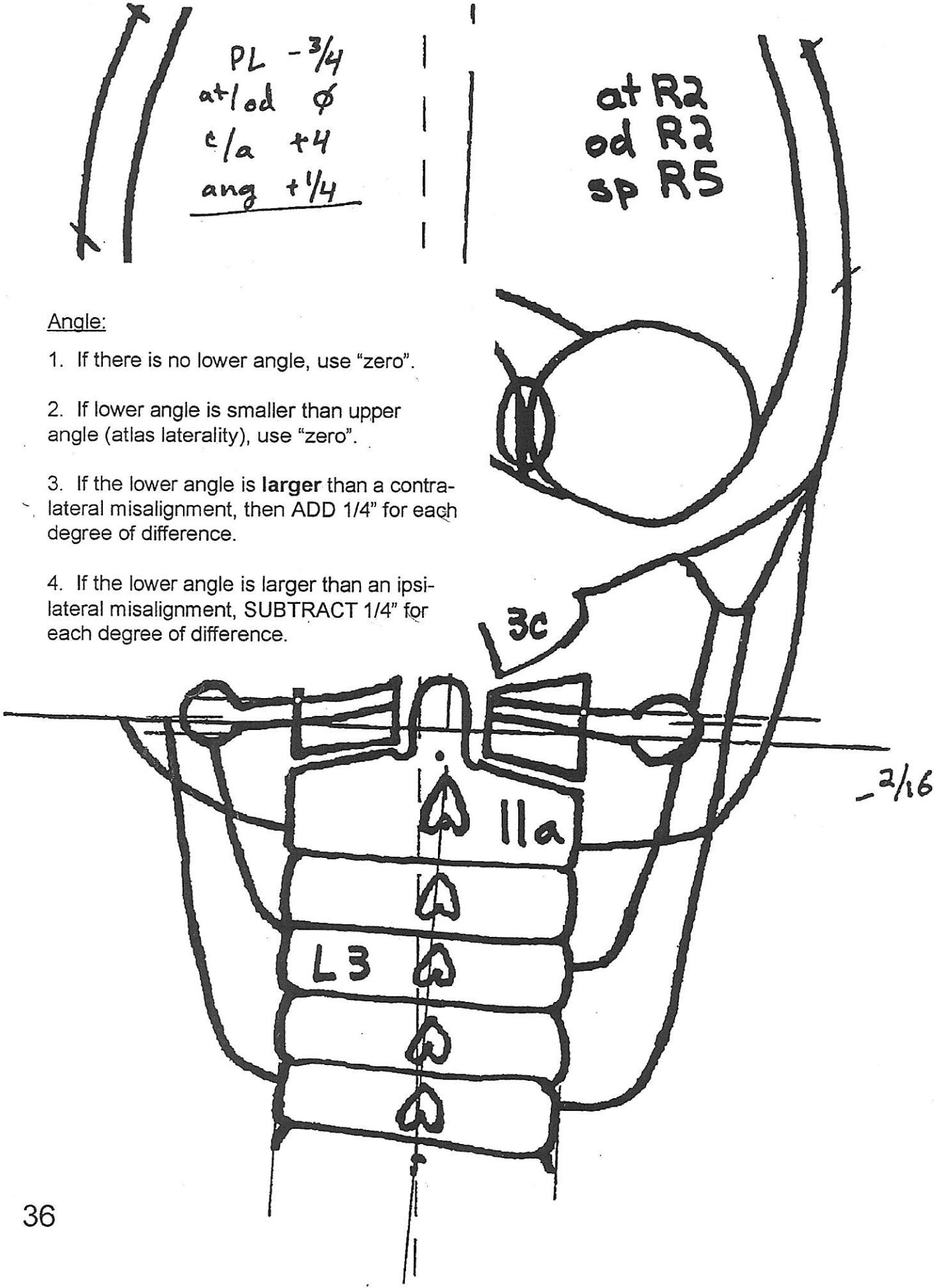


Refer to the condylar and axial circle measurements recorded on page 21.

Use the following formula: $\frac{A - C}{2}$; $\frac{11 - 3}{2} = 4$

If the condylar number includes a fraction, round down. If the axial does, round up.

angle Element



Angle:

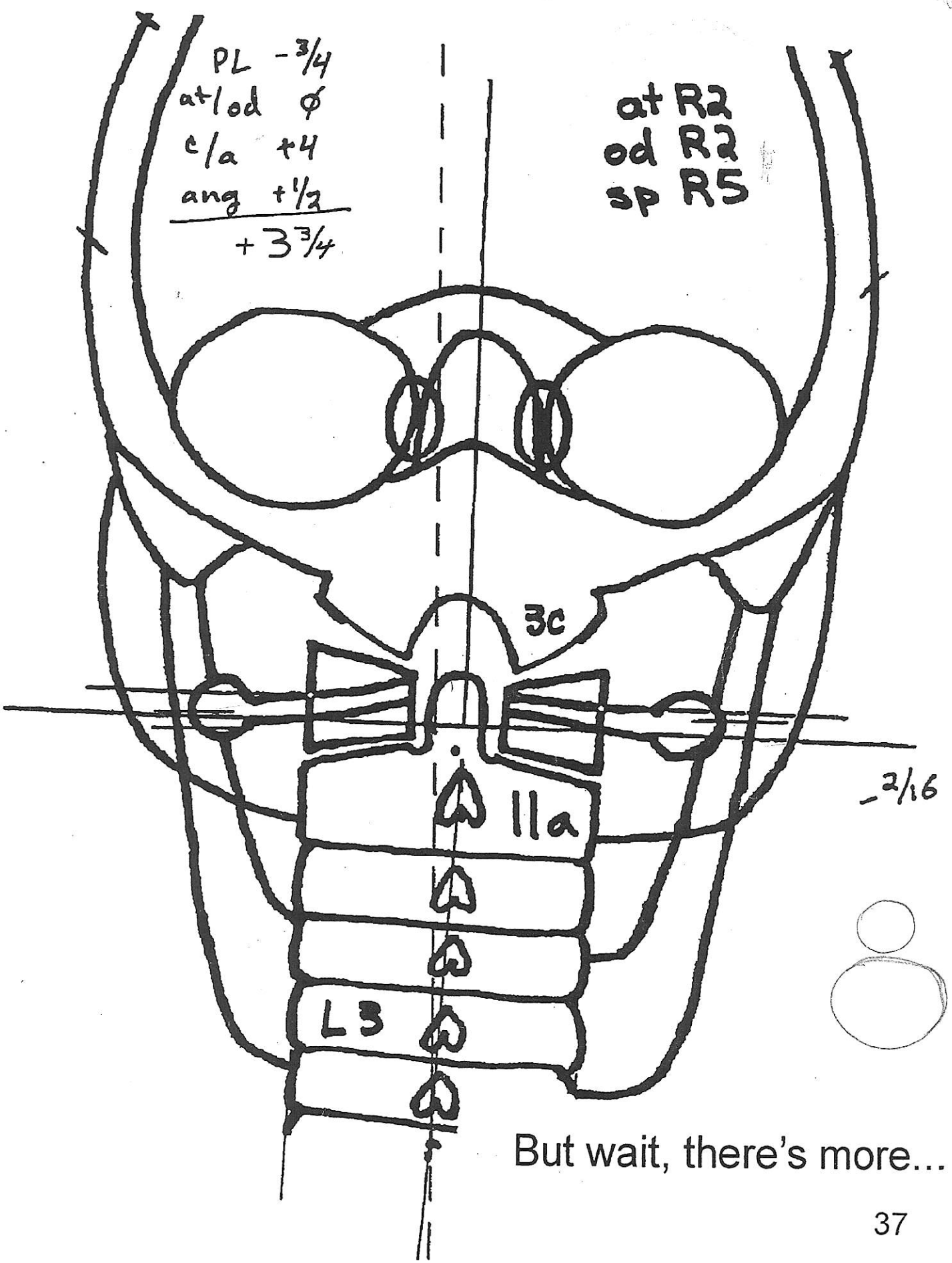
1. If there is no lower angle, use "zero".

2. If lower angle is smaller than upper angle (atlas laterality), use "zero".

3. If the lower angle is **larger** than a contra-lateral misalignment, then ADD 1/4" for each degree of difference.

4. If the lower angle is larger than an ipsi-lateral misalignment, SUBTRACT 1/4" for each degree of difference.

Calculate Height Vector



But wait, there's more...

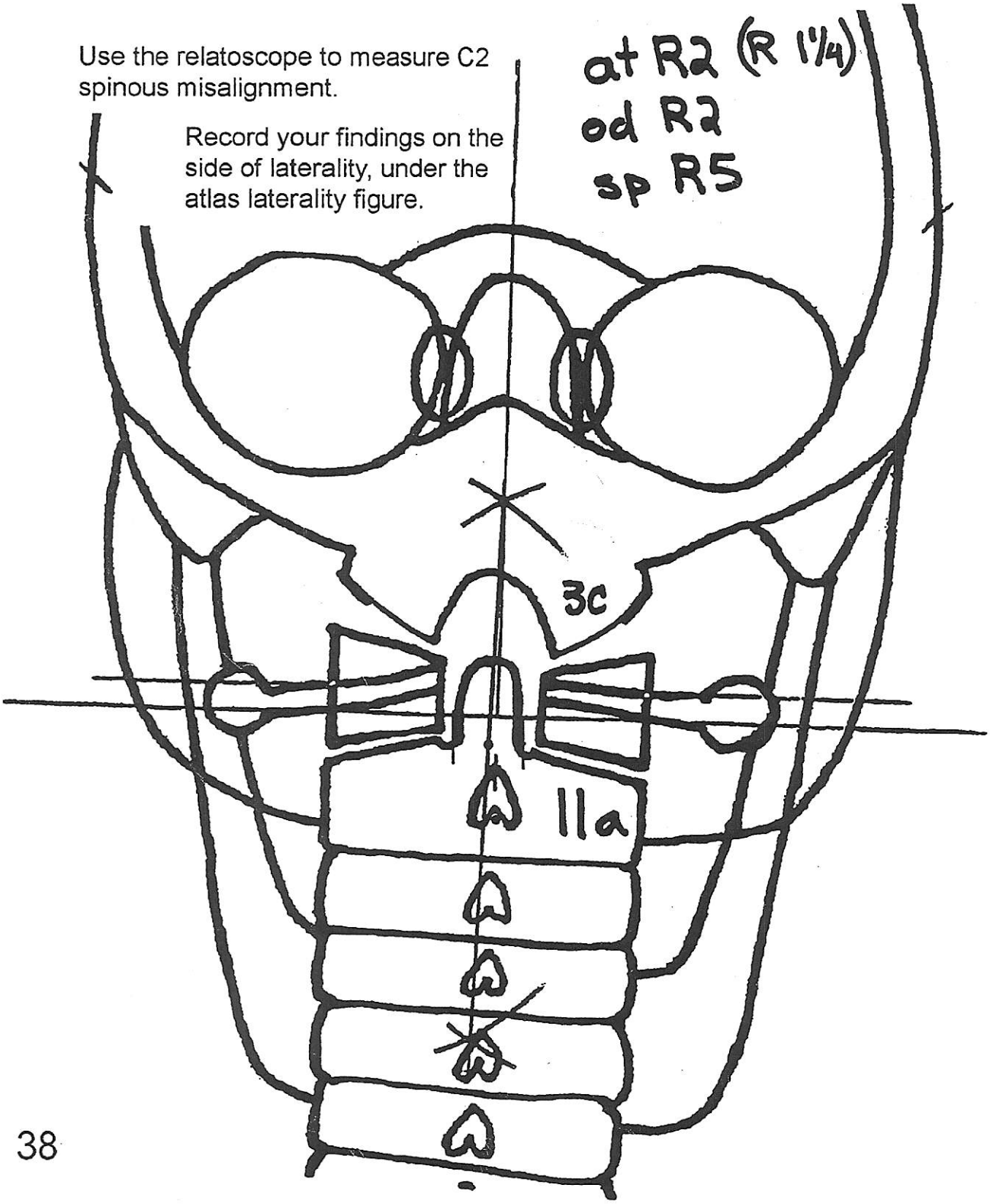
Nasium or Vertex, Nasium or Vertex?...

The C2 spinous can be measured on both kinds of films, nasium AND vertex. The vertex method is only accurate if the patient's head and neck were NOT moved during x-ray setup.

If the nasium film is used and the nasium shows accidental rotation on the film, then the spinous position may not be correct. Also if the t-spine is very lordotic or kyphotic, that may induce an error in C2 spinous rotation. It is very important to check both films. Below is the nasium method, the alternate is covered in the NUCCA textbook.

Use the relatoscope to measure C2 spinous misalignment.

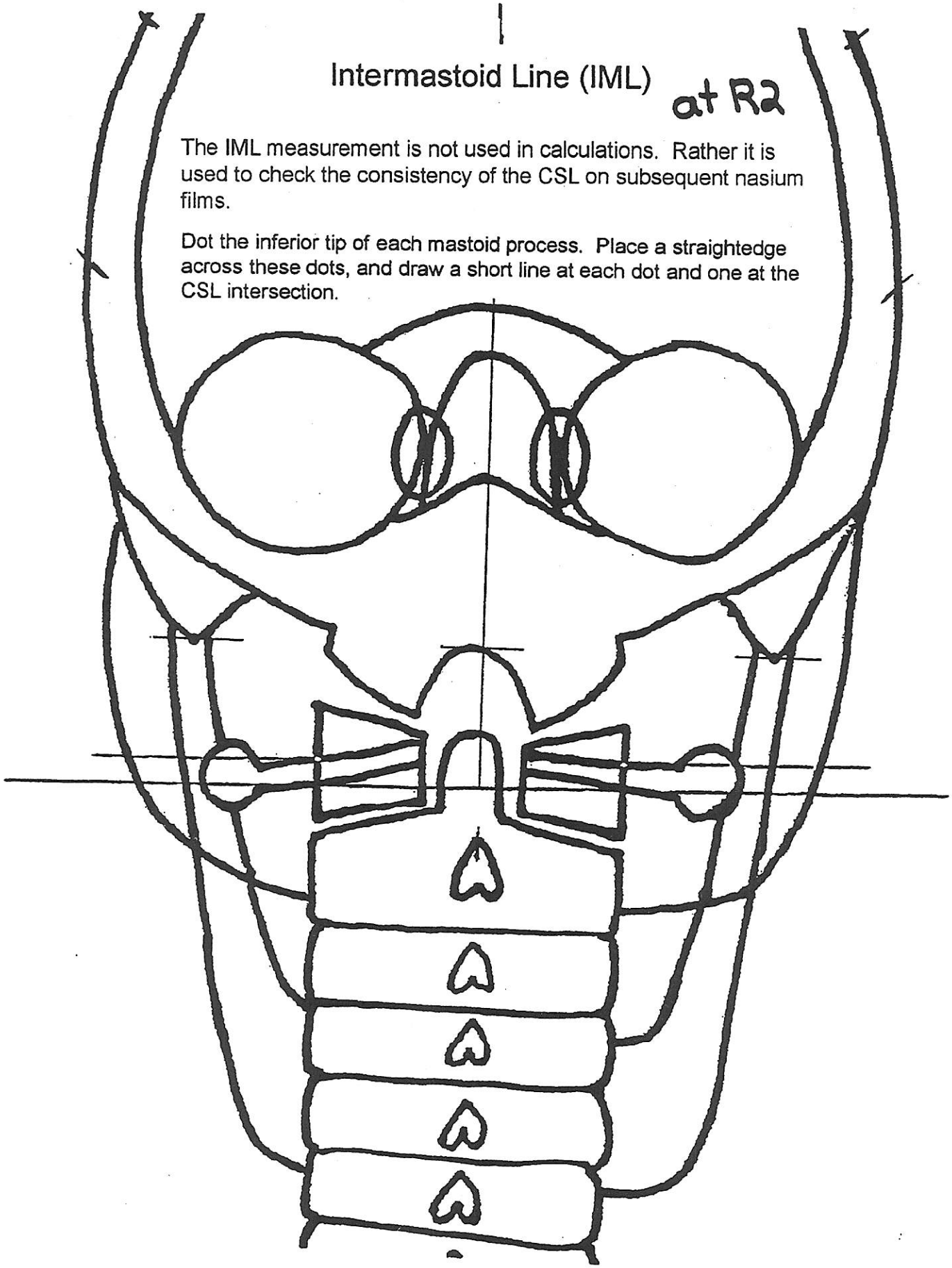
Record your findings on the side of laterality, under the atlas laterality figure.



Intermastoid Line (IML) at R2

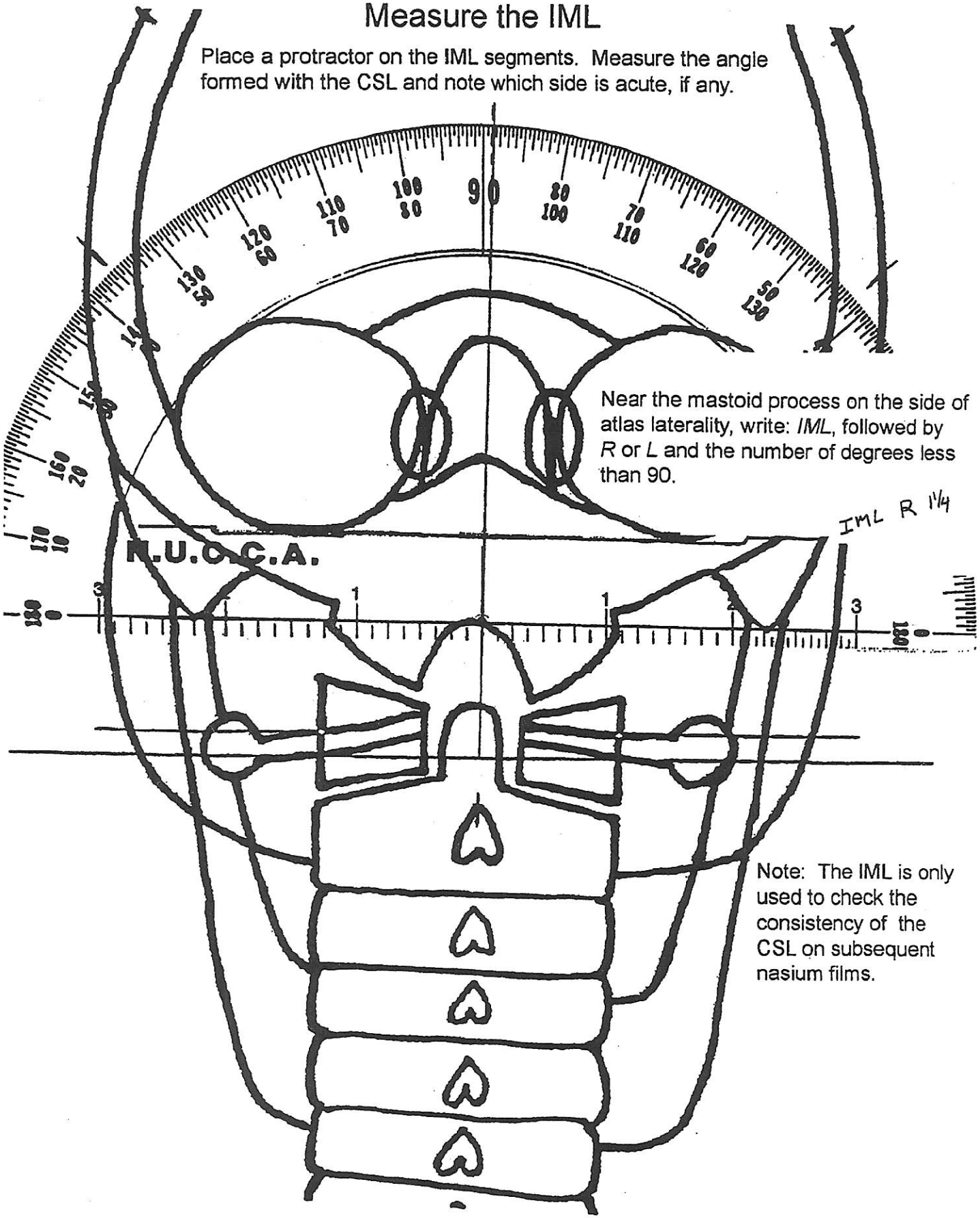
The IML measurement is not used in calculations. Rather it is used to check the consistency of the CSL on subsequent nasium films.

Dot the inferior tip of each mastoid process. Place a straightedge across these dots, and draw a short line at each dot and one at the CSL intersection.



Measure the IML

Place a protractor on the IML segments. Measure the angle formed with the CSL and note which side is acute, if any.



Near the mastoid process on the side of atlas laterality, write: *IML*, followed by *R* or *L* and the number of degrees less than 90.

Note: The IML is only used to check the consistency of the CSL on subsequent nasium films.