



Chiropractic BioPhysics

CBP—The Science of Spinal Health

Normal Thoracic Curve Template

The normal thoracic curve template was derived from the CBP study on modeling the thoracic kyphosis that was published in the Journal of Spinal Disorders and Techniques in June 2002. [Harrison DE, Janik TJ, Harrison DD, Cailliet R, Harmon S. Can the Thoracic Kyphosis be Modeled with a Simple Geometric Shape? The Results of Circular and Elliptical Modeling in 80 Asymptomatic Subjects. J Spinal Disord Tech 2002; 15(3): 213-220.]

We digitized 80 normal subjects' lateral full spine x-rays. We averaged the (x,y)-coordinates for each vertebral body corner. Then we passed "best fit" ellipses through the posterior vertebral body corners (along the posterior longitudinal ligament) using a least squares method. A very close approximation of this average thoracic kyphosis was modeled with an ellipse. Using this elliptical model, "concentric" ellipses were derived using the same minor axis to major axis ratio ($b/a = 0.72$) and same height-to-length ratio ($H/L = 0.96$).

These pieces of ellipses from T2 to T11 were cut out of plastic. Unlike previous CBP cervical and lumbar templates, the thoracic template has radial lines representing the width of disc spaces between the vertebrae from T12 through T1.

How to Draw the Normal Red Line – Black Line

Step 1: Locate and place a dot at posterior-inferior T11

Step 2: Draw the Vertical Axis Line (VAL) from posterior-inferior T11 until it passes through the T1 level

Step 3: Locate the inferior-posterior corner of T2. Place a dot and draw a horizontal line through this dot until it intersects the VAL. [Recall that for sagittal balance, posterior-inferior T2 should sit directly above posterior-inferior T11]

Step 4: Place the plastic thoracic template on the radiograph by rotating it until ends of the cut out curves as vertical [the plastic edges are NOT made to be vertical!]

Step 5: Slide the plastic template until a "best fit" ellipse is found that will have one cut out end (check the numbers at each end for symmetry) containing the dot at posterior-inferior T11. While the TOP end will NOT be at superior-posterior T2, but rather the **T2 inferior disc radial line** will be placed where the horizontal line (step 3) and the VAL (step2) meet.

Step 6: Draw in RED along the cut out curve for this best fit ellipse from inferior-posterior T11 to SUPERIOR-POSTERIOR T2

Step 7: Draw BLACK LINES along the posterior vertebral margins of T2 through T11.

Report: You are now ready to explain that "the red line is normal, the black lines are along your rib cage vertebrae. Can you see that your rib cage vertebrae are not normally aligned?"