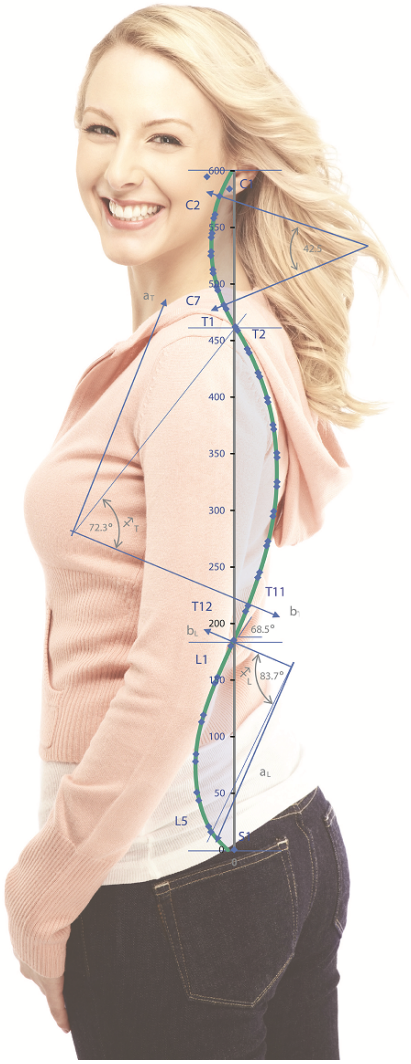
MODERN CHIROPRACTIC CENTER

# Radiographic Impression Report




| | |
|---|---|
| Prepared for: | Bad Spine |
| Patient #: | SpineBad2013629000 |
| Insurance #: | |
| Gender: | Male |
| Date of Birth: | 8/7/1954 |
| Address: | |
| Evaluation Date: | 7/19/2019 |
| Date X-Ray Taken: | 7/19/2019 |

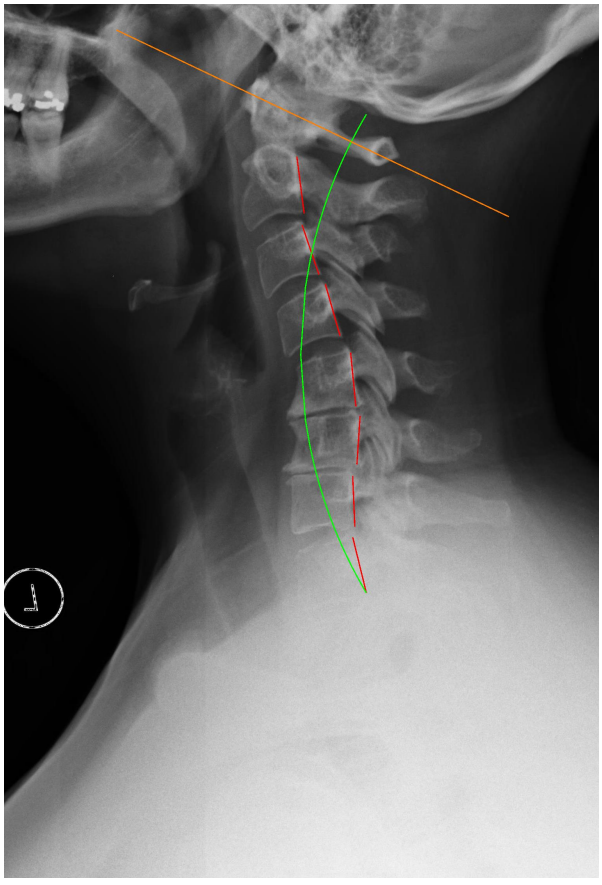
Prepared by:
Nasium Clinic
Someplace Drive
Somewhere Cityville, Florida
34653

MODERN CHIROPRACTIC CENTER

## Radiographic Impression Report — Lateral Cervical Projection

**Name: Bad Spine** **X-Ray was obtained: 7/19/2019** **Date of Digitization: 7/19/2019**
**Date of Birth: 8/7/1954**

Mr. Bad Spine's x-rays were analyzed utilizing the PostureRay® computerized X-ray digitizing system with impressions interpreted by Dr. Joe Ferrantelli. X-Ray digitization for spinal biomechanics has been shown to be valid when compared to standard hand drawn methods. The patient's findings were then compared to established normals at each level and then globally. The X-Ray mensuration method used in analyzing this patient have been studied for reliability and validity and these results are as follows:



**Anterior** **Posterior**

This green curved line represents the Normal Spinal Position and expected path of the posterior longitudinal ligament.

This red line represents the patient's position and the path of the posterior longitudinal ligament.

MODERN CHIROPRACTIC CENTER

## Radiographic Impression Report — Lateral Cervical Projection

### Spinal Biomechanics Compared to Normal

| Segments Analyzed | RRA Normal Values | RRA Patient Values | Difference From Normal | Segmental Translations* |
|---|---|---|---|---|
| C1 to Horiz. | -29.0º | -30.5º | 5.2% | |
| C2-C3 | -10.0º | -11.4º | 14.0% | -2.2 mm |
| C3-C4 | -8.0º | 2.9º | 136.2% | 0.2 mm |
| C4-C5 | -8.0º | 10.3º | 228.8% | 2.0 mm |
| C5-C6 | -8.0º | 9.3º | 216.2% | 1.1 mm |
| C6-C7 | -8.0º | -6.1º | 23.8% | -1.4 mm |
| C7-T1 | -8.0º | -11.4º | 42.5% | -1.6 mm |

RRA = Relative Rotational Angle of Measurement
* Values in Red Exceed Established Normal

| Global Analysis | Normal Values | Patient Values | Diff. From Normal |
|---|---|---|---|
| ARA C2-C7 (Segmental Sum.) | -42º | 5.0º | 111.9% |
| ARA C2-C7 (Global) | -42º | 5.0º | 111.9% |
| Translation C2-C7 | 0 mm | 17.8 mm | 17.8 mm |
| C7 Post. Tangent to Vert. | 21.5º | 2.4º | 88.8% |
| T1 Post. Tangent to Vert. | 26.5º | 13.8º | 47.9% |
| CBP C1-S1 | 0 mm | 55.4 mm | 55.4 mm |
| C7 Centroid - S1 Post. Sup. | 0 mm | 23.5 mm | 23.5 mm |
| T1 Post. Inf.- S1 Post. Inf. | 0 mm | 19.7 mm | 19.7 mm |

ARA = Absolute Rotational Angle of Measurement
Direction of measured displacements are indicated using the right-hand Cartesian coordinate system method in biomechanics. Consequently a "-" negative sign preceding a measured value indicates posterior translation for linear movements; and a "-" preceding angular measurements indicate relative segmental or global extension rotational movement.

| Cervical Morphology | Average Values | Patient Values | Diff. From Average |
|---|---|---|---|
| C2 Pos. body of C2 relative to APL | n/a | 57.2º | n/a |
| T1 Endplate line to horizontal | n/a | 17.7º | n/a |

APL = Atlas Plane Line
Direction of measured displacements are indicated using the right-hand Cartesian coordinate system method in biomechanics. Consequently a "-" negative sign preceding a measured value indicates posterior translation for linear movements; and a "-" preceding angular measurements indicate relative segmental or global extension rotational movement.

| Upper Cervical Measurements | Normal Values | Patient Values | Clinical Significance |
|---|---|---|---|
| Powers Ratio | 0.9 to 1 | Not Digitized | n/a |
| Basilar Impression (Macrae's method) | n/a | Not Digitized | n/a |
| Atlanto-Dental Interspace | ≤ 3 mm | 1.3 mm | WNL |
| Spinal Canal Diameter | > 13 mm | 27.7 mm | WNL |
| Chamberlain's line to horizontal | n/a | Not Digitized | n/a |

WNL = Within Normal Levels

## Impressions and Assessment

The posterior tangent method of radiographic analysis has been studied extensively for both validity and reliability[1;2-5], and has been shown to be a superior method of analysis for biomechanical assessment over the Cobb method of x-ray analysis for sagittal cervical spine.[3] Using this radiographic analysis technique, the normal cervical lordosis measured from C2-C7 for a normal average population was found to measure -34º with ideal alignment measuring -42º.[1;2] (Note that the negative sign preceding the measurement of degree indicates direction, thus the normal Lordotic/extended position and an abnormal flexion angle/kyphosis is noted by a positive angle). There is a statistically significant association between cervical pain and lordosis < -20º and a "clinically normal" range for cervical lordosis of -31º to -40º.[6] Further, there is no evidence that hypertonicity as seen in muscle spasms in muscle groups responsible for anterior cervical translation and head flexion have any significant impact on cervical lordosis.[7]

As noted in this computerized analysis, Mr. Bad Spine's cervical spine measures 5.0º. According to recent research, Mr. Bad Spine's cervical spine alignment is predictive of chronic neck pain.[1] This is a loss from the expected normal lordosis by 111.9%. Regarding anterior cervical translation (weight bearing) findings of less than 15mm has been established as a normal.[1;2] Mr. Bad Spine has an abnormal anterior cervical translation from C2 relative to C7 of 17.8mm.

Disc thinning noted C5/6. Disc thinning noted C6/7. Negative for fracture. No other pathologic findings noted.

## References

[1] Harrison DD, Harrison DE, Janik TJ et al. Modeling of the sagittal cervical spine as a method to discriminate hypolordosis: results of elliptical and circular modeling in 72 asymptomatic subjects, 52 acute neck pain subjects, and 70 chronic neck pain subjects. Spine (Phila Pa 1976.) 2004;29:2485-92.
[2] Harrison DD, Troyanovich SJ, Harrison DE et al. A normal sagittal spinal configuration: a desirable clinical outcome. J.Manipulative Physiol Ther. 1996;19:398-405.
[3] Harrison DE, Harrison DD, Cailliet R et al. Cobb method or Harrison posterior tangent method: which to choose for lateral cervical radiographic analysis. Spine (Phila Pa 1976.) 2000;25:2072-8.
[4] Harrison DE, Holland B, Harrison DD et al. Further reliability analysis of the Harrison radiographic line-drawing methods: crossed ICCs for lateral posterior tangents and modified Risser-Ferguson method on AP views. J.Manipulative Physiol Ther. 2002;25:93-8.
[5] Jackson BL, Harrison DD, Robertson GA et al. Chiropractic biophysics lateral cervical film analysis reliability. J.Manipulative.Physiol.Ther. 1993;16:384-91.
[6] McAviney J, Schulz D, Bock R et al. Determining the relationship between cervical lordosis and neck complaints. J.Manipulative Physiol Ther. 2005;28:187-93.
[7] Fedorchuk, CA, McCoy M, Lightstone DF, et al. Impact of Isometric Contraction of Anterior Cervical Muscles on Cervical Lordosis. J Radiol Case Rep. 2016 Sep 30;10(9):13-25. eCollection 2016

Signature electronically applied by Dr. Joe Ferrantelli

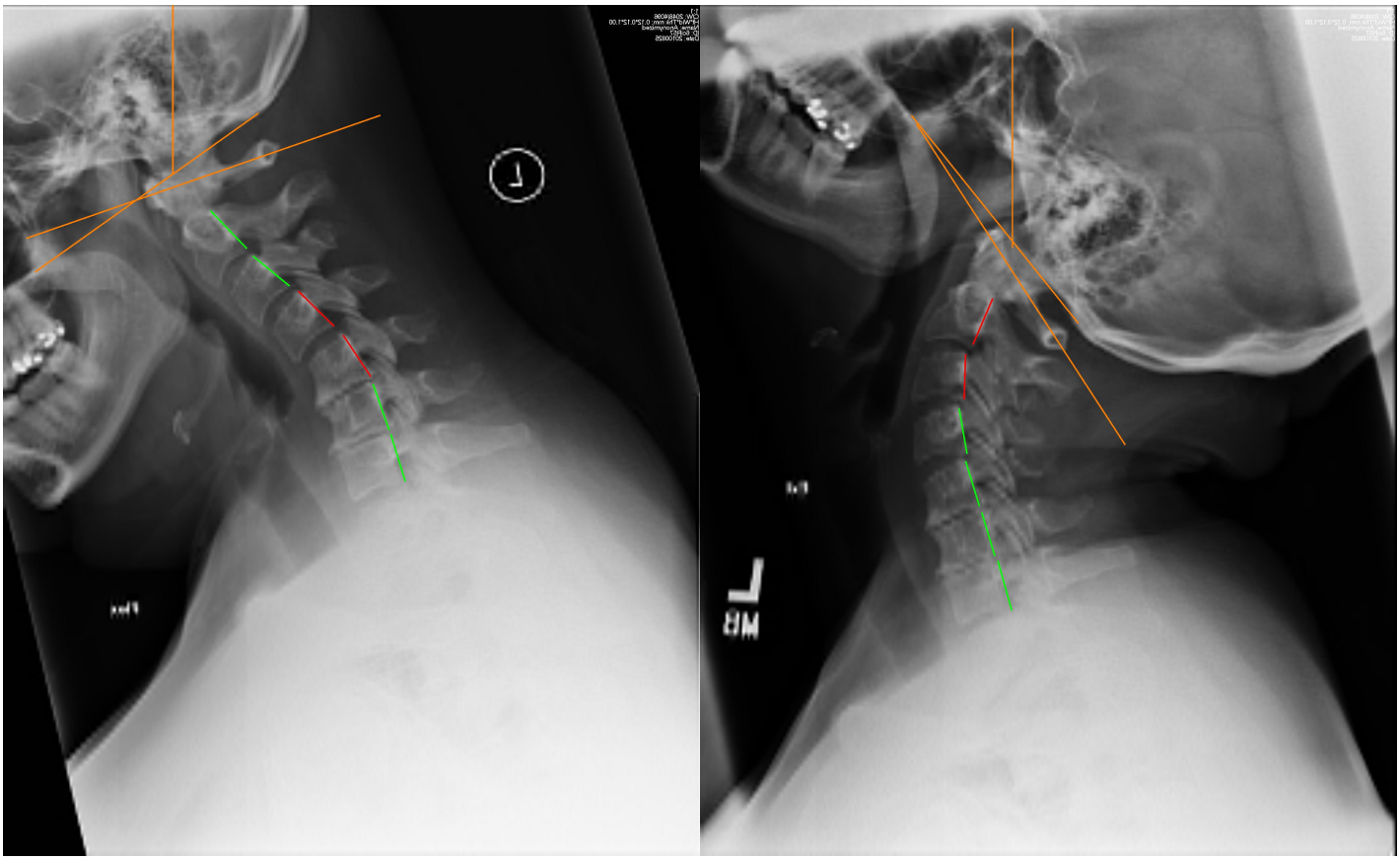
MODERN CHIROPRACTIC CENTER

## Radiographic Impression Report — Lateral Cervical Flexion/Extension

**Name: Bad Spine** **X-Ray was obtained: 7/19/2019** **Date of Digitization: 7/19/2019**
**Date of Birth: 8/7/1954**

Mr. Bad Spine's x-rays were analyzed utilizing the PostureRay® computerized X-ray digitizing system with impressions interpreted by Dr. Joe Ferrantelli. X-Ray digitization for spinal biomechanics has been shown to be valid when compared to standard hand drawn methods. The patient's findings were then compared to established normals at each level and then globally. The X-Ray mensuration method used in analyzing this patient have been studied for reliability and validity and these results are as follows:

**Flexion** **Extension**



**Anterior** **Posterior** **Anterior** **Posterior**

This red line represents the path of the posterior longitudinal ligament and exceeds normal allowable segmental motion indicating ligament laxity.

This green line is the path of the posterior longitudinal ligament and appears to be stable with no significant ligamentous laxity.

MODERN CHIROPRACTIC CENTER

## Radiographic Impression Report — Lateral Cervical Flexion/Extension

### Flexion/Extension Values

| Segment | Flexion RRA | Extension RRA | Angular Excursion | Flexion Transl.* | Extension Transl.* | Translational Excursion |
|---|---|---|---|---|---|---|
| C1 to Horiz. | 12.8º | -61.0º | 73.8º | | | |
| C2-C3 | -6.8º | **-21.4º** | 14.6º | -1.2 mm | -2.9 mm | 1.7 mm |
| C3-C4 | 5.1º | **-11.9º** | 17.0º | 0.2 mm | -2.7 mm | 2.9 mm |
| C4-C5 | **11.9º** | -7.0º | 18.9º | 0.4 mm | -1.6 mm | 2.0 mm |
| C5-C6 | **14.4º** | 0.3º | 14.1º | 0.3 mm | -0.1 mm | 0.4 mm |
| C6-C7 | 2.1º | 1.1º | 1.1º | 0.0 mm | 0.4 mm | -0.4 mm |
| C7-T1 | Not Digitized | Not Digitized | n/a | Not Digitized | Not Digitized | n/a |

RRA = Relative Rotational Angle of Measurement
* Values in Red Exceed Established Normal

| Global Analysis | Flexion | Extension | Global Excursion |
|---|---|---|---|
| ARA C2-C7 (Segmental Summation) | 26.7º | -38.9º | 65.6º |
| ARA C2-C7 (Global) | 26.8º | -38.8º | 65.6º |
| Translation C2-C7 | 68.7 mm | 6.7 mm | 62.0 mm |
| C7 Post. Tangent to Vert. | 17.1º | 15.6º | 1.5º |
| T1 Post. Tangent to Vert. | Not Digitized | Not Digitized | n/a |

ARA = Absolute Rotational Angle of Measurement
Direction of measured displacements are indicated using the right-hand Cartesian coordinate system method in biomechanics. Consequently a "-" negative sign preceding a measured value indicates posterior translation for linear movements; and a "-" preceding angular measurements indicate relative segmental or global extension rotational movement.

| Cervical Morphology | Flexion | Extension | Global Excursion |
|---|---|---|---|
| C0-C1 Chamberlain's to APL | -16.3º | 5.7º | -22.0º |
| C2 Pos. body of C2 relative to APL | 65.3º | 56.3º | 9.1º |

APL = Atlas Plane Line
Direction of measured displacements are indicated using the right-hand Cartesian coordinate system method in biomechanics. Consequently a "-" negative sign preceding a measured value indicates posterior translation for linear movements; and a "-" preceding angular measurements indicate relative segmental or global extension rotational movement.

| Upper Cervical Measurements - Flexion | Normal Values | Patient Values | Clinical Significance |
|---|---|---|---|
| Powers Ratio | 0.9 to 1 | 0.9 | WNL |
| Basilar Impression (Macrae's method) | n/a | WNL | WNL |
| Atlanto-Dental Interspace | ≤ 3 mm | 1.5 mm | WNL |
| Spinal Canal Diameter | > 13 mm | 24.9 mm | WNL |
| Chamberlain's line to horizontal | n/a | 35.4º | n/a |

WNL = Within Normal Levels

| Upper Cervical Measurements - Extension | Normal Values | Patient Values | Clinical Significance |
|---|---|---|---|
| Powers Ratio | 0.9 to 1 | 1.1 | Anterior Atlantooccipital dislocation may exist |
| Basilar Impression (Macrae's method) | n/a | WNL | WNL |
| Atlanto-Dental Interspace | ≤ 3 mm | 0.7 mm | WNL |
| Spinal Canal Diameter | > 13 mm | 27.3 mm | WNL |
| Chamberlain's line to horizontal | n/a | -51.2º | n/a |

WNL = Within Normal Levels

| Upper Cervical Measurements - Flexion + Extension | Normal Values | Patient Values | Clinical Significance |
|---|---|---|---|
| C0-C1 Instability | < 25º | Not Digitized | n/a |
| C1-C2 Instability | < 20º | 12.3º | WNL |

WNL = Within Normal Levels

## Impressions and Assessment

The posterior tangent method of radiographic analysis has been studied extensively for both validity and reliability[4-8], and has been shown to be a superior method of analysis for biomechanical assessment over the Cobb method of x-ray analysis for sagittal cervical spine.[6] Normal values for intersegmental motion should not exceed more than 10-11º of angular motion.[9] Using the posterior tangent method of radiographic analysis, motion that exceeds 10º has been shown to predict and discriminate minor ligamentous injuries from those patients with true whiplash type ligamentous injuries.[3] Corroborating these findings using another method of analysis (inferior endplate assessment), an alteration of motion segment integrity (AOMSI) has been defined as motion at the level in question that is more than 11º greater than at either adjacent level.[1] Regarding segmental translational movements, authors have noted that subluxation should be noted with a range of 1.0-3.0mm[2] of intersegmental movement with absolute clinical cutoff threshold value of 3.5mm.[1;9] Of additional importance, improvement in neutral lateral cervical lordosis has been shown to be associated with significant improvement in the translational and rotational motions of the lower cervical spine. Flexion/extension kinematics are partially dependent on the posture and sagittal curve orientation.[10]

There is anterior widening of the intervertebral disc space at C2-C3, C3-C4 levels evidenced by excessive segmental extension, which indicates possible damage to the anterior longitudinal ligament and/or intervertebral disc at said level. There is possible significant damage to the posterior longitudinal ligament and/or posterior intervertebral disc and/or interspinous ligament which is indicated by an increased widening of the posterior intervertebral disc space angulation and increased separation of spinous processes at the following levels: C4-C5, C5-C6.

- Segmental flexion instability is noted at the following segments: C4-C5 of 11.9º, C5-C6 of 14.4º.
- Segmental extension instability is noted at the following segments: C2-C3 of -21.4º, C3-C4 of -11.9º.
- Segmental subluxation for flexion is noted at the following segments: C2-C3 with -1.2 mm.

MODERN CHIROPRACTIC CENTER

## Radiographic Impression Report — Lateral Cervical Flexion/Extension

- Segmental subluxation for extension is noted at the following segments: C2-C3 with -2.9 mm, C3-C4 with -2.7 mm, C4-C5 with -1.6 mm.
- Segmental translational instability for flexion is noted at the following segments: none
- Segmental translational instability for extension is noted at the following segments: none

**Flexion View Impressions:** Very limited global ROM is noted with associated spinal coupling. No acute bony abnormalities or osseus disease.

**Extension View Impressions:** Very limited global ROM is noted with associated spinal coupling most noted mid to lower cervical spine. I suspect delayed instability will appear once more normal global ROM is achieved.

**According to the above biomechanical assessment, there are findings of alteration of motion segment integrity (AOMSI) at the following levels: C2-C3, C3-C4, C4-C5 and C5-C6. Consequently, this patient may be rateable for a permanent injury upon reaching maximal medical improvement.**

## References


[1] Guides to the Evaluation of Permanent Impairment, Fifth Edition.American Medical Association, 2000.
[2] Green JD, Harle TS, Harris JH, Jr. Anterior subluxation of the cervical spine: hyperflexion sprain. AJNR Am.J.Neuroradiol. 1981;2:243-50.
[3] Griffiths HJ, Olson PN, Everson LI et al. Hyperextension strain or "whiplash" injuries to the cervical spine. Skeletal Radiol. 1995;24:263-6.
[4] Harrison DD, Harrison DE, Janik TJ et al. Modeling of the sagittal cervical spine as a method to discriminate hypolordosis: results of elliptical and circular modeling in 72 asymptomatic subjects, 52 acute neck pain subjects, and 70 chronic neck pain subjects. Spine (Phila Pa 1976.) 2004;29:2485-92.
[5] Harrison DD, Troyanovich SJ, Harrison DE et al. A normal sagittal spinal configuration: a desirable clinical outcome. J.Manipulative Physiol Ther. 1996;19:398-405.
[6] Harrison DE, Harrison DD, Cailliet R et al. Cobb method or Harrison posterior tangent method: which to choose for lateral cervical radiographic analysis. Spine (Phila Pa 1976.) 2000;25:2072-8.
[7] Harrison DE, Holland B, Harrison DD et al. Further reliability analysis of the Harrison radiographic line-drawing methods: crossed ICCs for lateral posterior tangents and modified Risser-Ferguson method on AP views. J.Manipulative Physiol Ther. 2002;25:93-8.
[8] Jackson BL, Harrison DD, Robertson GA et al. Chiropractic biophysics lateral cervical film analysis reliability. J.Manipulative.Physiol.Ther. 1993;16:384-91.
[9] White AA, III, Johnson RM, Panjabi MM et al. Biomechanical analysis of clinical stability in the cervical spine. Clin.Orthop. 1975;85-96.
[10] Moustafa IM, et al. Does rehabilitation of cervical lordosis influence sagittal cervical spine flexion extension kinematics in cervical spondylotic radiculopathy subjects? J Back Musculoskelet Rehabil. 2016 Mar 27. doi: 10.3233/BMR-150464.

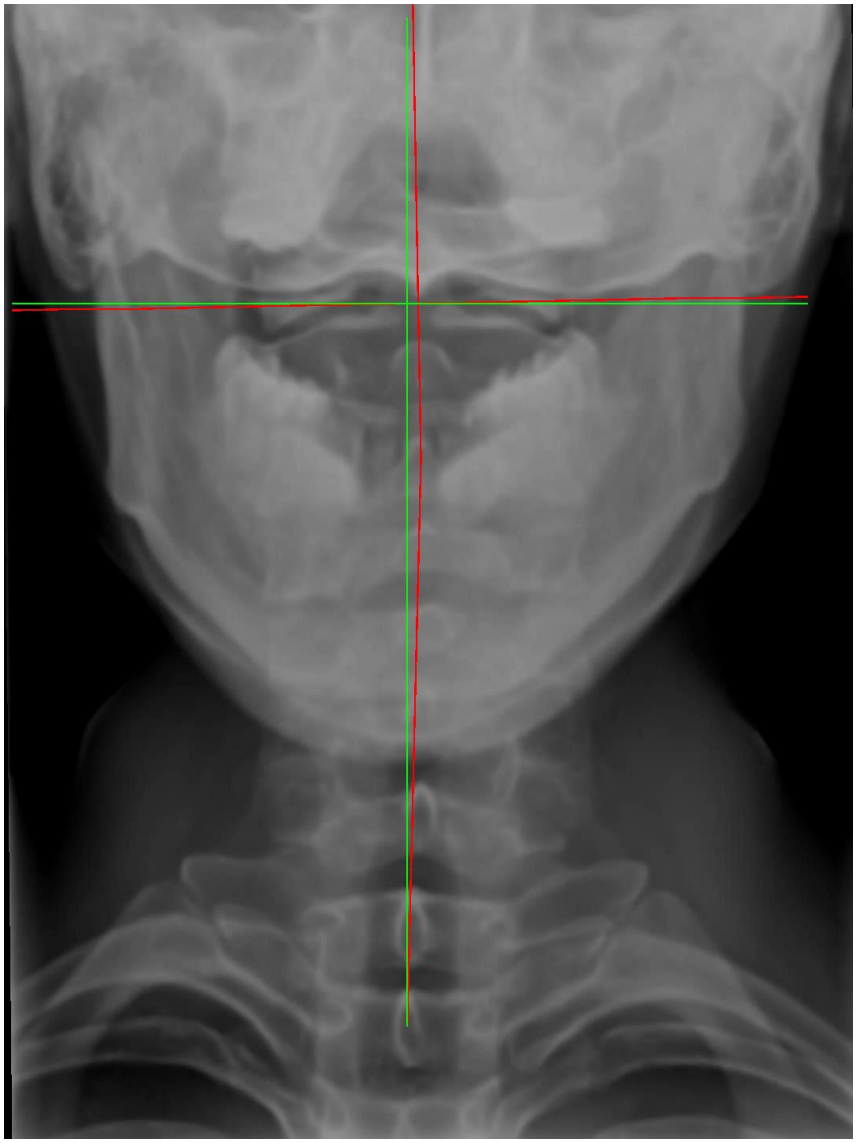

Signature electronically applied by Dr. Joe Ferrantelli

MODERN CHIROPRACTIC CENTER

## Radiographic Impression Report — AP Open Mouth

**Name: Bad Spine** **X-Ray was obtained: 7/19/2019** **Date of Digitization: 7/19/2019**
**Date of Birth: 8/7/1954**

Mr. Bad Spine's x-rays were analyzed utilizing the PostureRay® computerized X-ray digitizing system with impressions interpreted by Dr. Joe Ferrantelli. X-Ray digitization for spinal biomechanics has been shown to be valid when compared to standard hand drawn methods. The patient's findings were then compared to established normals at each level and then globally. The X-Ray mensuration method used in analyzing this patient have been studied for reliability and validity and these results are as follows:



**Right** **Left**

The horizontal green line represents the normal atlas position. The vertical green line is a plumb line, also indicating normal vertical spinal alignment.

The horizontal red line represents the patient's Atlas vertebrae position. Ideally this should superimpose the green normal horizontal line. The red vertically oriented line should superimpose the true green vertical plumb line in spines with normal alignment.

MODERN CHIROPRACTIC CENTER

## Radiographic Impression Report — AP Open Mouth

### Neutral Values

| Global Analysis | Normal Values | Patient Values | Difference From Normal | Clinical Significance |
|---|---|---|---|---|
| C0-C1 Lat. Flex. Angle | 0.0º | 4.5º | 4.5º | WNL |
| C1-C2 Lat. Flex. Angle | 0.0º | 0.5º | 0.5º | WNL |
| C2-C3 Lat. Flex. Angle | 0.0º | 1.1º | 1.1º | WNL |
| Left C1-C2 "overhang" margin | 0.0 mm | right -0.3 mm | 0.3 mm | WNL |
| Right C1-C2 "overhang" margin | 0.0 mm | right -1.3 mm | 1.3 mm | WNL |
| C2 Axial Spinous Rotation | 0.0º | left 0.4º | 0.4º | |

WNL = Within Normal Levels

Direction of measured displacements are indicated using the right-hand Cartesian coordinate system method in biomechanics. Consequently a "-" negative sign preceding a measured value indicates left translation for linear movements; and a "-" preceding angular measurements indicate relative segmental or global rotational movement to the left.

### Impressions and Assessment

As noted above in the table for the neutral position, Mr. Bad Spine has a 0.3 mm right shift of C1 relative to the lateral body margin of C2 on the left side. On the patient's right side, there is a 1.3 mm right shift of C1 relative to the lateral body margin of C2.

No  acute bony abnormalities or osseus disease.

Signature electronically applied by Dr. Joe Ferrantelli

MODERN CHIROPRACTIC CENTER

## Radiographic Impression Report — AP Cervical Projection

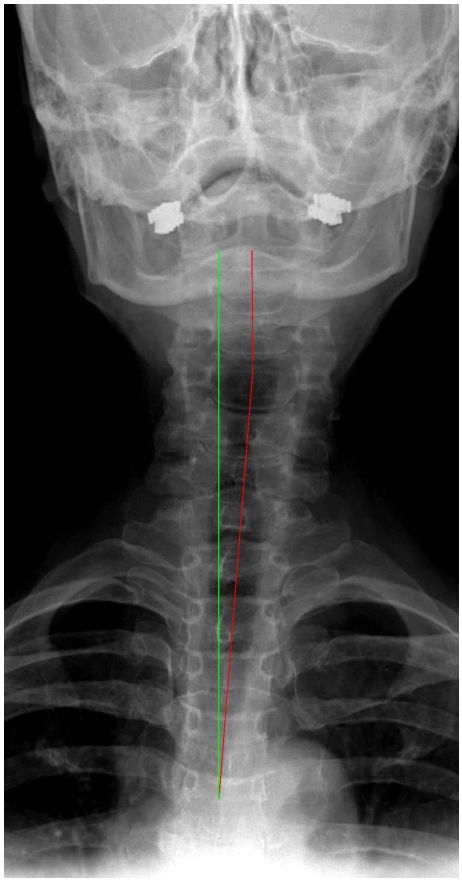
**Name: Bad Spine** **X-Ray was obtained: 7/19/2019** **Date of Digitization: 7/19/2019**
**Date of Birth: 8/7/1954**

Mr. Bad Spine's x-rays were analyzed utilizing the PostureRay® computerized X-ray digitizing system with impressions interpreted by Dr. Joe Ferrantelli. X-Ray digitization for spinal biomechanics has been shown to be valid when compared to standard hand drawn methods. The patient's findings were then compared to established normals at each level and then globally. The X-Ray mensuration method used in analyzing this patient have been studied for reliability and validity and these results are as follows:

### Spinal Biomechanics Compared to Normal

| Global Analysis | Normal Values | Patient Values | Difference From Normal |
|---|---|---|---|
| RZA T5 | 0º | -4.6º | 4.6º |
| CDA C2-T5 | 0º | 5.4º | 5.4º |
| Translation C2-T5 | 0 mm | 10.7 mm | 10.7 mm |

CDA = Cervico-dorsal Angle and is a measure of the mid cervical angle
RZA = Rotation Angle relative to true vertical of the lower cervical and upper thoracic spine



**Right** **Left**

This green line represents normal spinal position.

This red line represents the patient's alignment and the projected centers of mass of the spine.

### Impressions and Assessment

The x-ray analysis performed on this AP cervico-thoracic view has been studied for reliability and demonstrated both intraexaminaer and interexaminer reliability.[1] As noted above in the table, Mr. Bad Spine's cervical spine is translated (listed) from plumb by 10.7 mm to the left. Of importance is that the patient has a mid neck abnormal angle of 5.4 degrees to the right. The patient has an angular displacement from normal (plumb) of the lower cervical and upper thoracic spine of 4.6 degrees to the left.

No acute bony abnormalities or osseus disease. Mild to moderate diffuse degenerative changes noted.

### References

[1] Troyanovich SJ, Harrison DE, et al. Chiropractic Biophysics Digitized Radiographic Mensuration Analysis of the Anteroposterior Cervicothoracic View: A Reliability Study. JMPT 2000 Sep Vol. 23, Num 7: 476-482.

Signature electronically applied by Dr. Joe Ferrantelli

MODERN CHIROPRACTIC CENTER

## Radiographic Impression Report

## Nasium Cervical/Thoracic Projection

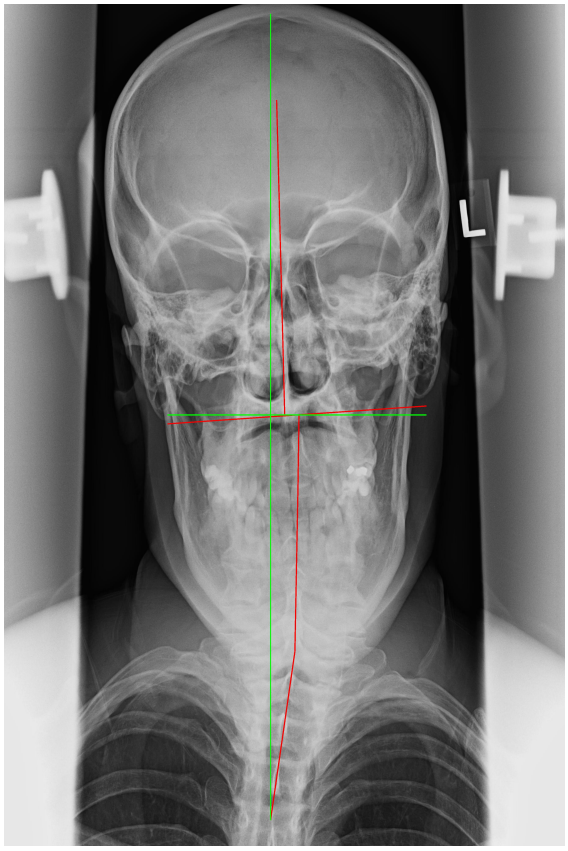
**Name: Bad Spine** **X-Ray was obtained: 7/19/2019** **Date of Digitization: 7/19/2019**
**Date of Birth: 8/7/1954**

Mr. Bad Spine's x-rays were analyzed utilizing the PostureRay® computerized X-ray digitizing system with impressions interpreted by Dr. Joe Ferrantelli. X-Ray digitization for spinal biomechanics has been shown to be valid when compared to standard hand drawn methods. The patient's findings were then compared to established normals at each level and then globally. The X-Ray mensuration method used in analyzing this patient have been studied for reliability and validity and these results are as follows:

### Spinal Biomechanics Compared to Normal

| Global Analysis | Normal Values | Patient Values | Diff. From Normal |
|---|---|---|---|
| CDA C2-T4 (C7 apex) | 0º | 7.4º | 7.4º |
| Left C1-C2 "overhang" | 0 mm | 1.2 mm | 1.2 mm |
| Right C1-C2 "overhang" | 0 mm | -0.3 mm | 0.3 mm |
| C2 Spinous Rotation | 0º | 1.8º | 1.8º |
| Upper Angle | 0º | 2.5º left (87.5º) | 2.5º |
| Lower Angle | 0º | 5.0º right (85.0º) | 5.0º |
| Translation C2-T4 | 0 mm | 13.3 mm | 13.3 mm |

CDA = Cervico-dorsal Angle and is a measure of the mid cervical angle




**Right** **Left**

The green line represents normal spinal position.

The red line represents the patient's alignment and the projected centers of mass of the spine.

### Impressions and Assessment

As noted in the table, Mr. Bad Spine has a 1.2 mm left shift of C1 relative to the lateral body margin of C2 on the left side. On the patient's right side, there is a -0.3 mm right shift of C1 relative to the lateral body margin of C2. Concerning the angular findings of atlas relative to the skull, Mr. Bad Spine's spine denotes an upper angle measurement of 2.5 degrees to the left and a lower angle of 5.0 degrees to the right. Ideal alignment in this region of the upper cervical region is should approximate 0 degrees of offset of the upper angle and lower angle - meaning the skull sits perpendicular to the Atlas bone. The spine is translated (listed) from plumb by 13.3 mm to the left. Of importance, is that the paient has a mid neck cervico-dorsal angle of 7.4 degrees to the right.

Mild degenerative changes noted at C1/C2/3. Dens and C1 appear unremarkable for bony abnormalities.

Signature electronically applied by Dr. Joe Ferrantelli

MODERN CHIROPRACTIC CENTER

## Radiographic Impression Report — Lateral Thoracic Projection

**Name: Bad Spine** **X-Ray was obtained: 7/19/2019** **Date of Digitization: 7/19/2019**
**Date of Birth: 8/7/1954**

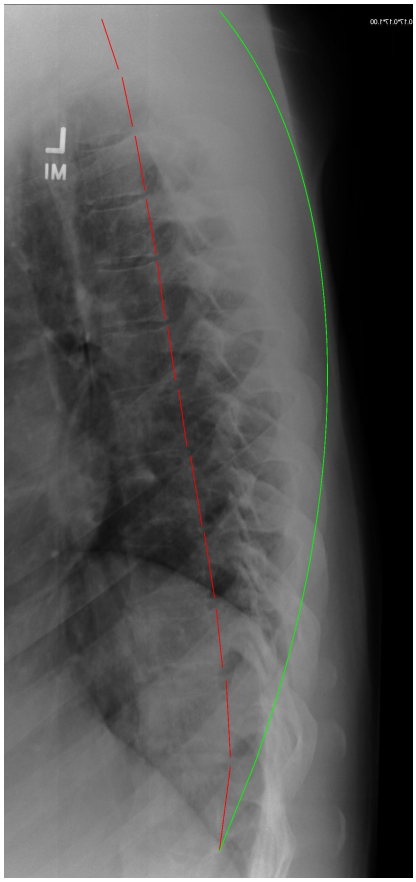
Mr. Bad Spine's x-rays were analyzed utilizing the PostureRay® computerized X-ray digitizing system with impressions interpreted by Dr. Joe Ferrantelli. X-Ray digitization for spinal biomechanics has been shown to be valid when compared to standard hand drawn methods. The patient's findings were then compared to established normals at each level and then globally. The X-Ray mensuration method used in analyzing this patient have been studied for reliability and validity and these results are as follows:

### Spinal Biomechanics Compared to Normal

| Segments Analyzed | RRA Normal Values | RRA Patient Values | Difference From Normal | Segmental Translations * |
|---|---|---|---|---|
| T1-T2 | -1.0º | 6.4º | 740.0% | 0.6 mm |
| T2-T3 | 4.0º | 1.8º | 55.0% | 0.1 mm |
| T3-T4 | 5.0º | 0.0º | 100.0% | -0.3 mm |
| T4-T5 | 6.0º | 2.6º | 56.7% | 0.0 mm |
| T5-T6 | 5.0º | -0.5º | 110.0% | 0.8 mm |
| T6-T7 | 6.0º | -0.1º | 101.7% | 0.8 mm |
| T7-T8 | 6.0º | -1.0º | 116.7% | 1.0 mm |
| T8-T9 | 4.0º | 0.2º | 95.0% | 0.5 mm |
| T9-T10 | 3.0º | 3.0º | 0.0% | 0.2 mm |
| T10-T11 | 3.0º | 3.0º | 0.0% | 1.2 mm |
| T11-T12 | 3.0º | 10.5º | 250.0% | 0.2 mm |

| Global Analysis | Normal Values | Patient Values | Difference From Normal |
|---|---|---|---|
| ARA T1-T12 | 44.0º | 25.8º | 41.4% |
| ARA T2-T11 | 42.0º | 8.9º | 78.8% |
| ARA T3-T10 | 37.0º | 4.1º | 88.9% |
| Translation T1-T12 | 0.0 mm | 49.0 mm | 49.0 mm |

RRA = Relative Rotational Angle of Measurement
ARA = Absolute Rotational Angle of Measurement
* Values in Red Exceed Established Normal
Direction of measured displacements are indicated using the right-hand Cartesian coordinate system method in biomechanics. Consequently a "-" negative sign preceding a measured value indicates posterior translation for linear movements; and a "-" preceding angular measurements indicate relative segmental or global extension rotational movement.
Values derived from sectional view for higher level of validity



**Anterior** **Posterior**

This green curve represents the Normal Spinal Position and expected path of the posterior longitudinal ligament.

This red line represents the patient's position and the path of the posterior longitudinal ligament.

### Impressions and Assessment

The x-ray mensuration analysis used in this analysis has been studied and shown to be superior and more valid to methods such as Centroid and Cobb analysis of the thoracic kyphosis.[1] The normal thoracic kyphosis has an established elliptical shape with an overall normal angulation measuring 44° T1-T12. 42° T2-T11, and 37° T3-T10.[2] As noted above in the table, Mr. Bad Spine's thoracic kyphosis is decreased 41.4% compared to normal. The patient has a forward thoracic translation from T1 relative to T12 of 49.0 mm. There is an overall hypokyphosis noted in the thoracic spine.

No acute bony abnormalities or osseus disease. Mild diffuse degenerative changes are noted.

## References

[1] Harrison DE, Cailliet R, Harrison DD et al. Reliability of Centroid, Cobb, and Harrison Posterior Tangent Methods: Which to Choose for Analysis of Thoracic Kyphosis JMPT 2000 Sep Vol. 23, Num 7: 476-482.

[2] Harrison DE, Janik T, Harrison DD, et al. Can the Thoracic Kyphosis be Modeled with a Simple Geometric Shape? The Results of Circular and Elliptical Modeling in 80 Asymptomatic Patients. J Spinal Disord Tech. 2002 Jun;15(3):213-20.

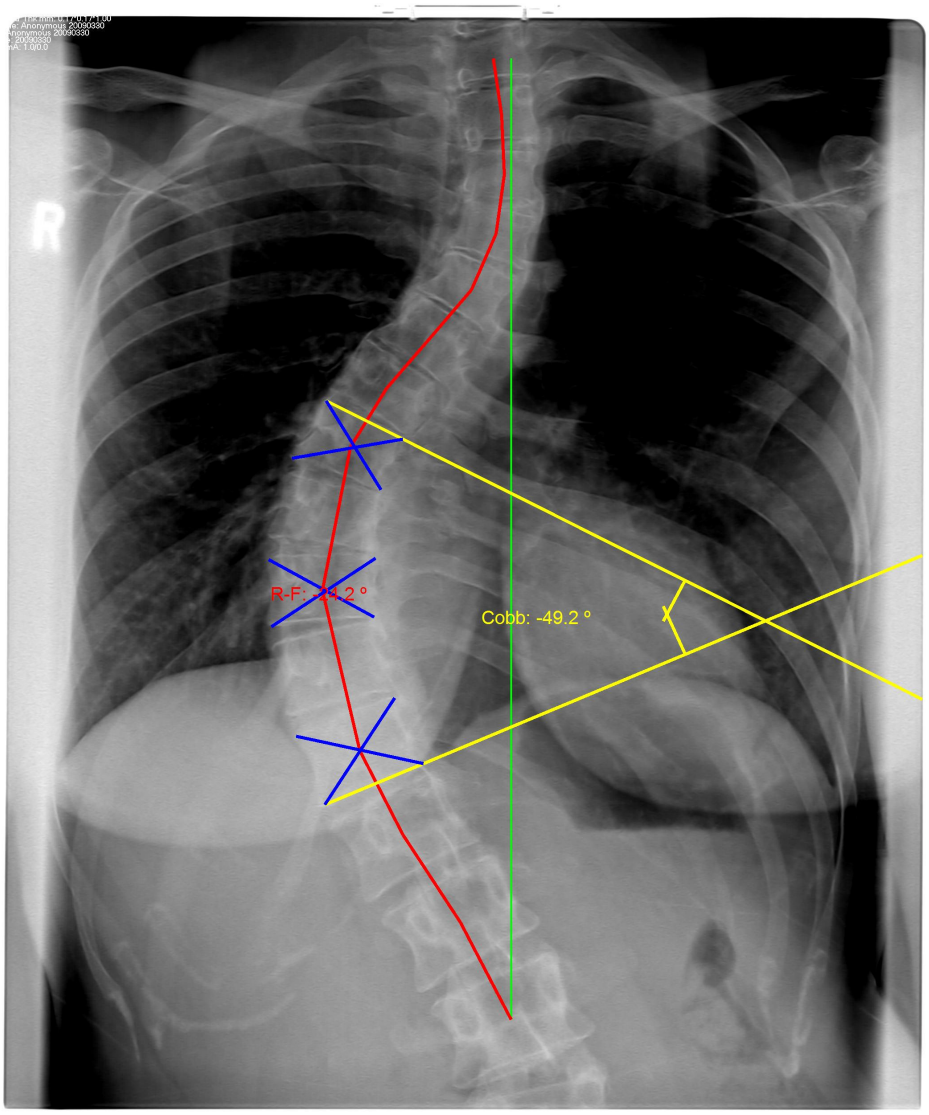
Signature electronically applied by Dr. Joe Ferrantelli

MODERN CHIROPRACTIC CENTER

## Radiographic Impression Report — AP Thoracic Scoliosis Projection

**Name: Bad Spine** **X-Ray was obtained: 7/19/2019** **Date of Digitization: 7/19/2019**
**Date of Birth: 8/7/1954**

Mr. Bad Spine's x-rays were analyzed utilizing the PostureRay® computerized X-ray digitizing system with impressions interpreted by Dr. Joe Ferrantelli. X-Ray digitization for spinal biomechanics has been shown to be valid when compared to standard hand drawn methods. The patient's findings were then compared to established normals at each level and then globally. The X-Ray mensuration method used in analyzing this patient have been studied for reliability and validity and these results are as follows:




**Right** **Left**

This green line represents normal spinal position.

This red line represents the patient's alignment and the projected centers of mass of the spine.
R-F: Risser-Ferguson Method of analysis
Cobb: Cobb Method of analysis

MODERN CHIROPRACTIC CENTER

## Radiographic Impression Report — AP Thoracic Scoliosis Projection

### Spinal Biomechanics Compared to Normal

| Global Analysis | Normal Values | Patient Values | Difference From Normal |
|---|---|---|---|
| Risser-Ferguson Angle T8-T12 (T10) | 0.0º | -24.2º | 24.2º |
| Cobb Angle T8-T12 | 0.0º | -49.2º | 49.2º |
| Translation at Apex T8-T12 (T10) | 0.0 mm | -14.4 mm | 14.4 mm |
| Translation T8-T12 | 0.0 mm | -3.6 mm | 3.6 mm |
| Translation T1-L3 | 0.0 mm | -7.3 mm | 7.3 mm |
| Clavicular angle to horizontal | 0.0º | Not Digitized | Not Digitized |

Direction of measured displacements are indicated using the right-hand Cartesian coordinate system method in biomechanics. Consequently a "-" negative sign preceding a measured value indicates left translation for linear movements; and a "-" preceding angular measurements indicate relative segmental or global rotational movement to the left.

Mr. Bad Spine has a 1 curve scoliosis at T8-T12 with the apex on the right at T10. Using the Risser-Ferguson method of analysis, Mr. Bad Spine's scoliosis measures -24.2 degrees (moderate), and using the Cobb method of analysis measures -49.2 degrees (severe).

No  acute bony abnormalities or osseus disease. Mild diffuse degenerative changes are noted. Scoliosis as noted.

Signature electronically applied by Dr. Joe Ferrantelli

MODERN CHIROPRACTIC CENTER

## Radiographic Impression Report — Lateral Lumbar Projection

**Name: Bad Spine** **X-Ray was obtained: 7/19/2019** **Date of Digitization: 7/19/2019**
**Date of Birth: 8/7/1954**

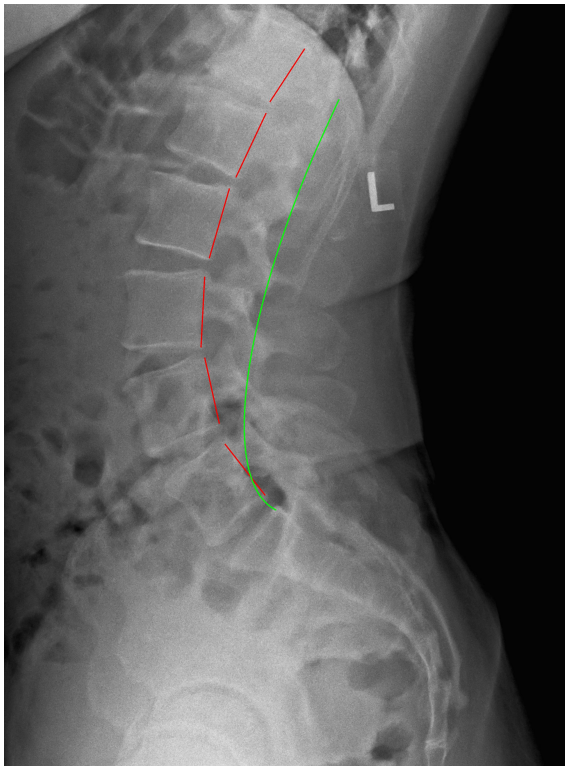
Mr. Bad Spine's x-rays were analyzed utilizing the PostureRay® computerized X-ray digitizing system with impressions interpreted by Dr. Joe Ferrantelli. X-Ray digitization for spinal biomechanics has been shown to be valid when compared to standard hand drawn methods. The patient's findings were then compared to established normals at each level and then globally. The X-Ray mensuration method used in analyzing this patient have been studied for reliability and validity and these results are as follows:

### Spinal Biomechanics Compared to Normal

| Segments Analyzed | RRA Normal Values | RRA Patient Values | Difference From Normal | Segmental Translations* |
|---|---|---|---|---|
| T112-L1 | -1º | -8.0º | 700.0% | 0.2 mm |
| L1-L2 | -5º | -9.1º | 82.0% | -1.9 mm |
| L2-L3 | -6º | -13.2º | 120.0% | -1.7 mm |
| L3-L4 | -9º | -15.5º | 72.2% | 0.2 mm |
| L4-L5 | -19º | -25.6º | 34.7% | -3.1 mm |
| L5-S1 | -33º | -18.2º | 44.8% | -1.7 mm |
| Sacral Base | 40º | 49.1º | 22.7% | |

| Global Analysis | Normal Values | Patient Values | Diff. From Normal |
|---|---|---|---|
| ARA L1-L5 | -40º | -63.4º | 58.5% |
| Translation T12-S1 | 0 mm | 30.1 mm | 30.1 mm |
| Pelvic Tilt | 50º | Not Digitized | Not Digitized |
| Pelvic Incidence | 56º | Not Digitized | Not Digitized |
| CBP PTPIA | 67º | Not Digitized | Not Digitized |
| CBP C1-S1 | 0 mm | 55.4 mm | 55.4 mm |
| C7 Centroid - S1 Post. Sup. | 0 mm | 23.5 mm | 23.5 mm |
| T1 Post. Inf.- S1 Post. Inf. | 0 mm | 19.7 mm | 19.7 mm |

RRA = Relative Rotational Angle of Measurement
ARA = Absolute Rotational Angle of Measurement
PTPIA = Posterior Tangent Pelvic Incidence Angle
WNL = Within Normal Levels
* Values in Red Exceed Established Normal
Values derived from sectional view for higher level of validity




**Anterior** **Posterior**

This green line represents the Normal Spinal Position and expected path of the posterior longitudinal ligament.

This red line represents the patient's position and the path of the posterior longitudinal ligament.

MODERN CHIROPRACTIC CENTER

## Radiographic Impression Report — Lateral Lumbar Projection

### Impressions and Assessment

The x-ray mensuration utilized in this assessment has been studied and noted to have high inter- and intra-examiner reliability[1] and also to be preferred method of analysis when compared to Cobb and Centroid, and Trall analysis especially when the angle of lordosis is to be measured.[2] Normal lordosis for the lumbar spine has been demonstrated and for individuals with normal morphology, it has been found that those with a hyperlordosis were associated with acute lumbar pain, compared to those with chronic lumbar pain demonstrating a hypolordosis. Thus altered configurations of the normal elliptical anthropometric model of the lumbar lordosis may clinically correlate with the development of degenerative changes in the spinal tissues and production of low back pain syndromes.[3]

As noted above in the table, Mr. Bad Spine has an overall increase from normal lordosis by 58.5%. The patient has a anterior translation from T12 relative to S1 of 30.1 mm.

No  acute bony abnormalities or osseus disease.

### References


[1] Troyanovich SJ, Robertson GA, Harrison DD, Holland B. Intra- and interexaminer reliability of the chiropractic biophysics lateral lumbar radiographic mensuration procedure. J Manipulative Physiol Ther. 1995 Oct;18(8):519-24.

[2] Harrison DE, Harrison DD, et al. Radiographic Analysis of Lumbar Lordosis, Centroid, Cobb, TRALL, and Harrison Posterior Tangent Methods. Spine (Phila Pa 1976). 2001 Jun 1;26(11):E235-42.

[3] (3) Harrison DD, Cailliet R et al. Elliptical modeling of the sagittal lumbar lordosis and segmental rotation angles as a method to discriminate between normal and low back pain subjects. J Spinal Disord. 1998 Oct;11(5):430-9.

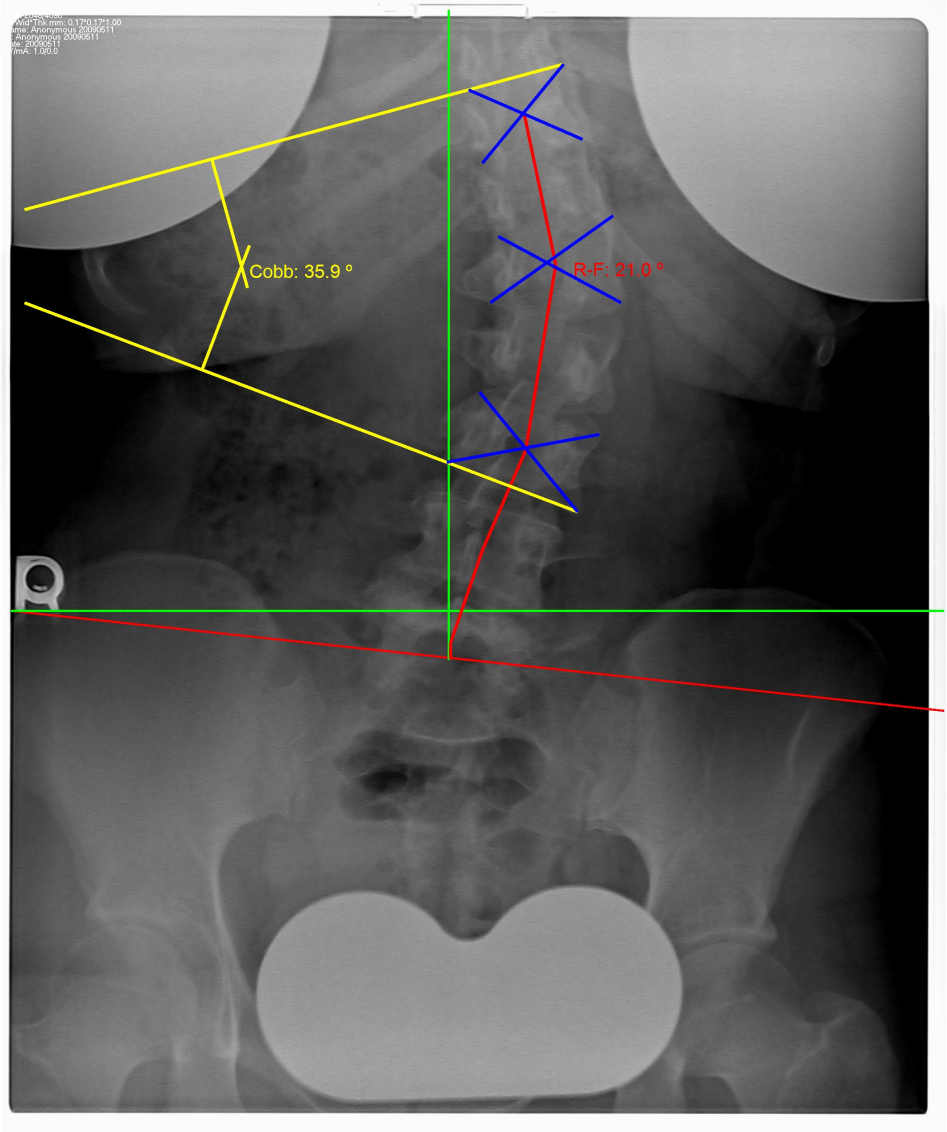

Signature electronically applied by Dr. Joe Ferrantelli

MODERN CHIROPRACTIC CENTER

## Radiographic Impression Report — AP Lumbar Scoliosis Projection

**Name: Bad Spine** **X-Ray was obtained: 7/19/2019** **Date of Digitization: 7/19/2019**
**Date of Birth: 8/7/1954**

Mr. Bad Spine's x-rays were analyzed utilizing the PostureRay® computerized X-ray digitizing system with impressions interpreted by Dr. Joe Ferrantelli. X-Ray digitization for spinal biomechanics has been shown to be valid when compared to standard hand drawn methods. The patient's findings were then compared to established normals at each level and then globally. The X-Ray mensuration method used in analyzing this patient have been studied for reliability and validity and these results are as follows:




**Right** **Left**

This green line represents normal spinal position.

This red line represents the patient's alignment and the projected centers of mass of the spine.
R-F: Risser-Ferguson Method of analysis
Cobb: Cobb Method of analysis

MODERN CHIROPRACTIC CENTER

## Radiographic Impression Report — AP Lumbar Scoliosis Projection

### Spinal Biomechanics Compared to Normal

| Global Analysis | Normal Values | Patient Values | Difference From Normal |
|---|---|---|---|
| Risser-Ferguson Angle T11-L3 (L1) | 0.0º | 21.0º | 21.0º |
| Cobb Angle T11-L3 | 0.0º | 35.9º | 35.9º |
| Translation at Apex T11-L3 (L1) | 0.0 mm | 11.6 mm | 11.6 mm |
| Translation T11-L3 | 0.0 mm | -0.6 mm | 0.6 mm |
| Translation T11-S1 | 0.0 mm | 28.4 mm | 28.4 mm |
| HB Angle | 0.0º | -6.1º | 6.1º |

HB Angle = the angle formed by a line across the sacral base relative to horizontal.

Direction of measured displacements are indicated using the right-hand Cartesian coordinate system method in biomechanics. Consequently a "-" negative sign preceding a measured value indicates left translation for linear movements; and a "-" preceding angular measurements indicate relative segmental or global rotational movement to the left.

Mr. Bad Spine has a 1 curve scoliosis at T11-L3 with the apex on the left at L1. Using the Risser-Ferguson method of analysis, Mr. Bad Spine's scoliosis measures 21.0 degrees (moderate), and using the Cobb method of analysis measures 35.9 degrees (moderate).

Mild diffuse degenerative changes are noted. No  acute bony abnormalities or osseus disease.

Signature electronically applied by Dr. Joe Ferrantelli

MODERN CHIROPRACTIC CENTER

## Radiographic Impression Report

## AP Modified Ferguson View (Sacral Base)

**Name: Bad Spine** **X-Ray was obtained: 7/19/2019** **Date of Digitization: 7/19/2019**

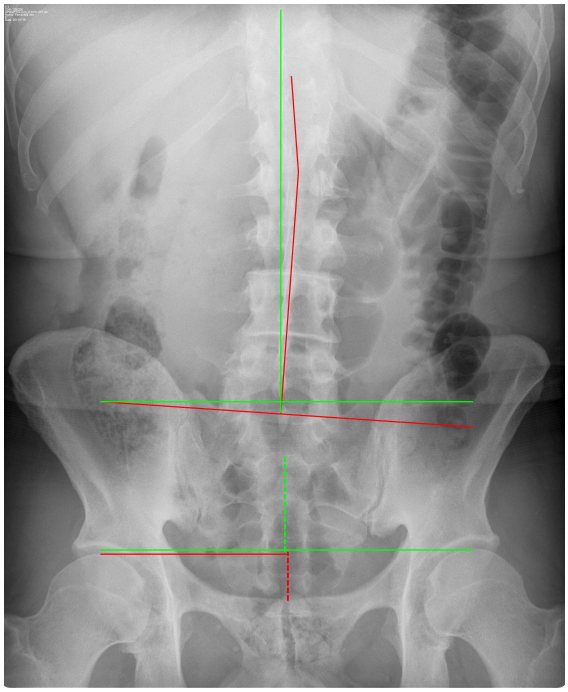
**Date of Birth: 8/7/1954**

Mr. Bad Spine's x-rays were analyzed utilizing the PostureRay® computerized X-ray digitizing system with impressions interpreted by Dr. Joe Ferrantelli. X-Ray digitization for spinal biomechanics has been shown to be valid when compared to standard hand drawn methods. The patient's findings were then compared to established normals at each level and then globally. The X-Ray mensuration method used in analyzing this patient have been studied for reliability and validity and these results are as follows:

### Spinal Biomechanics Compared to Normal

| Global Analysis | Normal Values | Patient Values | Difference From Normal |
|---|---|---|---|
| Femur Unleveling* | 0 mm | right 1.9 mm | 1.9 mm |
| Sacral Base Unleveling* | 0 mm | left 11.9 mm | 11.9 mm |
| Pubic Symphysis to S2 | 0 mm | left 1.9 mm | 1.9 mm |
| HB Angle | 0º | -3.9º | 3.9º |
| LS Angle T12-L5 (L2 apex) | 90º | -89.4º | 0.6º |
| LD Angle T12-L5 | 0º | 8.8º | 8.8º |
| Translation T12-S1 | 0 mm | 6.7 mm | 6.7 mm |

* Accounting for magnification
HB Angle = the angle formed by a line across the sacral base relative to horizontal.
LS Angle = Lumbo-sacral angle
LD Angle = Lumbar-Dorsal angle



**Right** **Left**

This green line represents normal spinal position.

This red line represents the patient's alignment and the projected centers of mass of the spine.

### Impressions and Assessment

As noted above in the table, the left side of the sacrum is deficient by 15.9mm accounting for magnification, it measures 11.9mm. The Femur offset is 2.6mm short on the right side which approximates 1.9mm, when accounting for magnification. As for the Pubic Symphysis offset to S2, it measures 1.9mm to the left.

There are sufficient visible vertebrae to measure that Mr. Bad Spine's upper lumbar spine is translated (listed) from plumb by 6.7 mm to the left. The patient has a mid lumbar curve of 8.8 degrees. The patient's sacral base is offset and inferior on the left.

This is an exam with a 12mm lift on the left - full orthotic.

Signature electronically applied by Dr. Joe Ferrantelli

MODERN CHIROPRACTIC CENTER

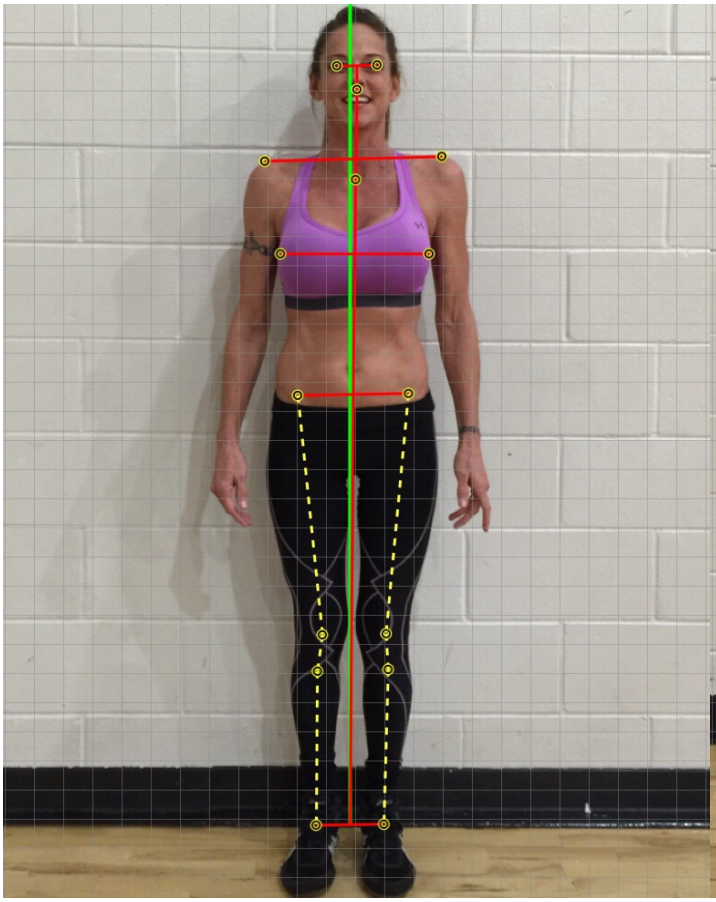
## Radiographic Impression Report

## Other View - PA Back Posture

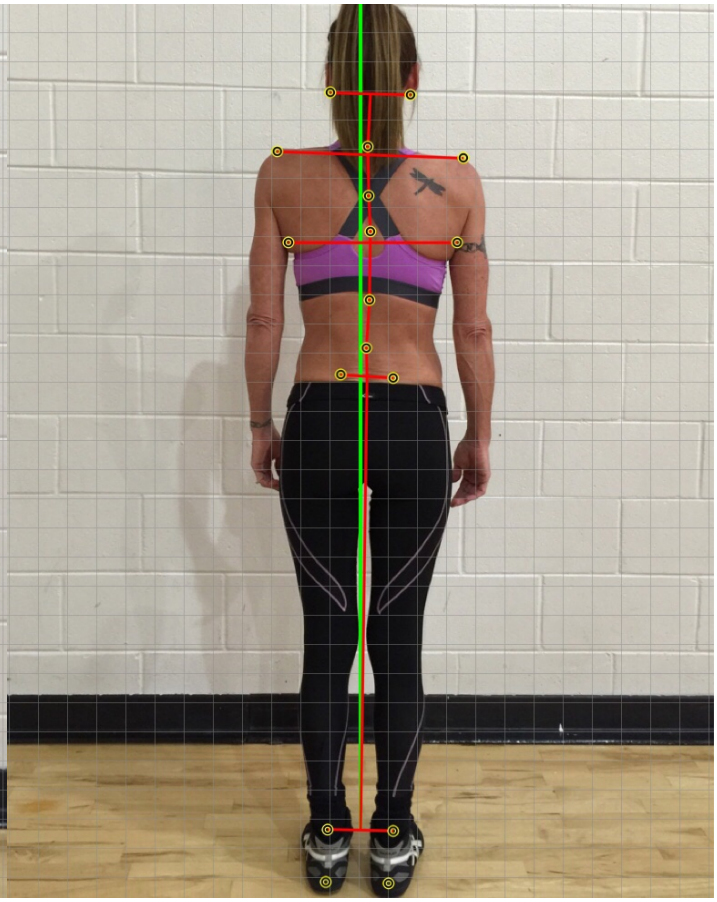
**Name: Bad Spine** **X-Ray was obtained: 7/19/2019** **Date of Digitization: 7/19/2019**

**Date of Birth: 8/7/1954**

### AP Front Posture



### PA Back Posture



Signature electronically applied by Dr. Joe Ferrantelli

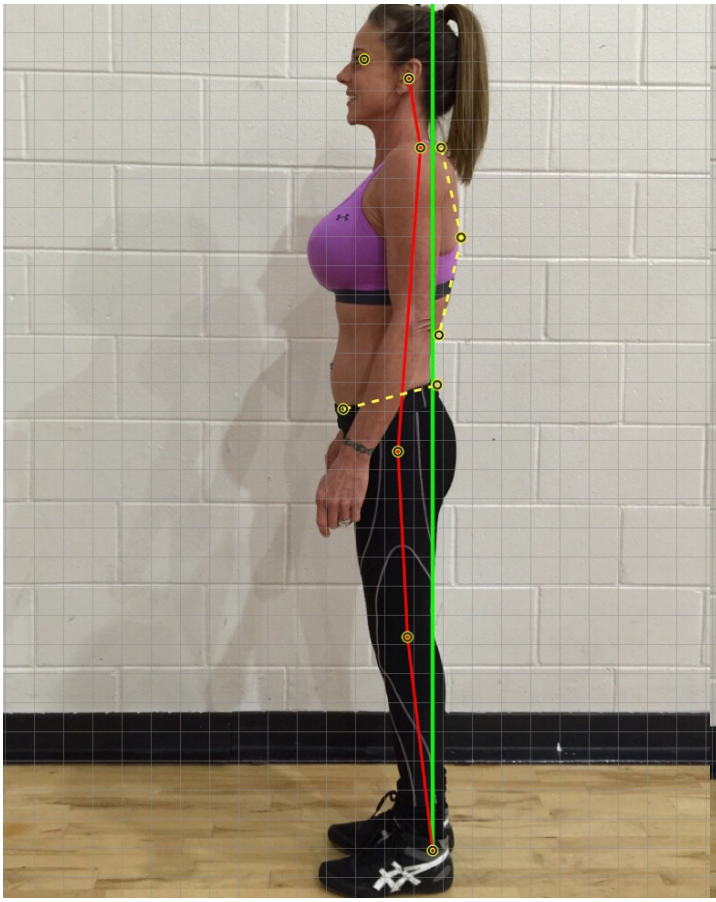
MODERN CHIROPRACTIC CENTER

## Radiographic Impression Report

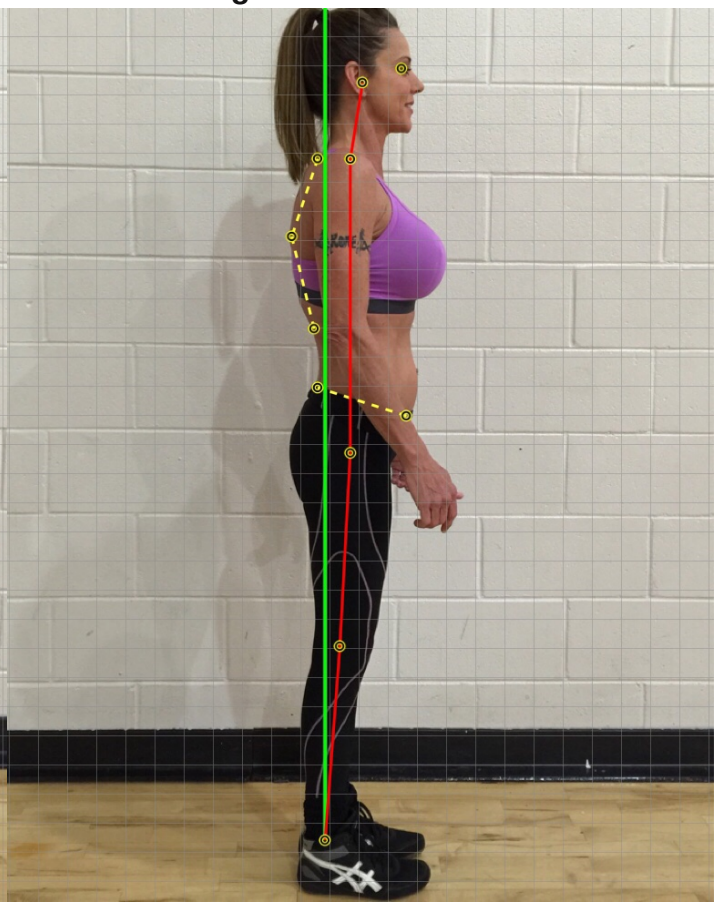
## Other View - Right Lateral Posture

**Name: Bad Spine** **X-Ray was obtained: 7/19/2019** **Date of Digitization: 7/19/2019**
**Date of Birth: 8/7/1954**

### Left Lateral Posture



### Right Lateral Posture



Signature electronically applied by Dr. Joe Ferrantelli