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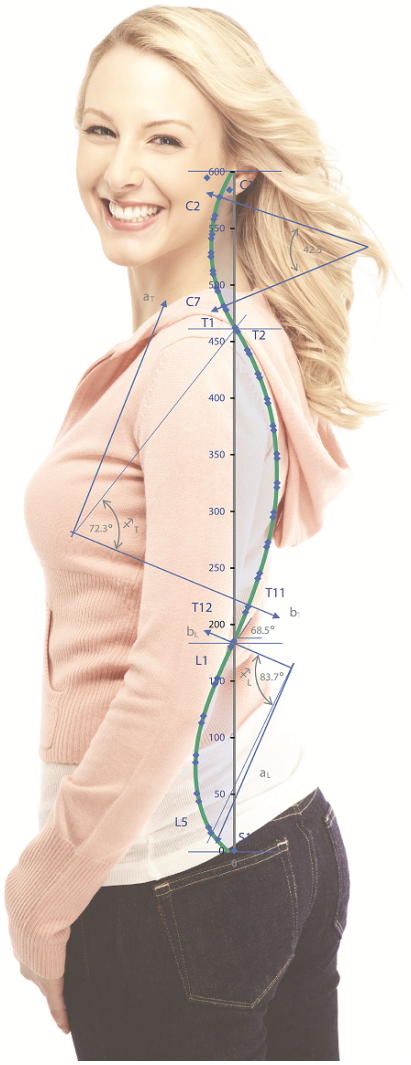
Radiographic Impression Report



Prepared for:	IMA Aiken
Patient #:	AikenIMA2017715000
Insurance #:	
Gender:	Male
Date of Birth:	1/2/1996
Address:	
Evaluation Date:	10/13/2017
Date X-Ray Taken:	10/13/2017

Prepared by:
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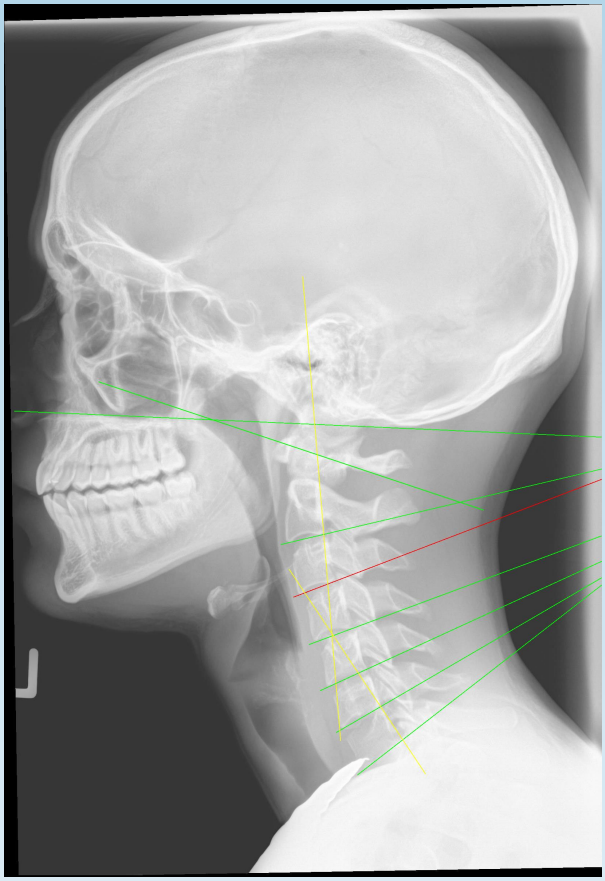
Radiographic Impression Report — Lateral Cervical Projection

Name: IMA Aiken **X-Ray was obtained: 10/13/2017** **Date of Digitization: 10/13/2017**
Date of Birth: 1/2/1996

Mr. IMA Aiken's x-rays were analyzed utilizing the PostureRay® computerized X-ray digitizing system with impressions interpreted by Roderic Rochester, DC, FCCJP. 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**

Vertebral base lines are drawn at the bottom of the vertebrae to assess alignment. In the cervical spine, these lines should converge in the back of the spine and should not be parallel nor divergent.

This green ine represents the normal range vertebral base line.

This red line represents the abnormal vertebral base line.

This yellow line is a posterior stress line drawn at each extremity of the cervical curve.

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Radiographic Impression Report — Lateral Cervical Projection

Spinal Biomechanics Compared to Normal

Angular Analysis	Normal Values	Patient Values	Diff. From Normal
C2-C7 Angle	-42.0º	-29.0º	31.0%

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.

Translational Analysis	Normal Values	Patient Values	Diff. From Normal
Translation C2-C3	< 3.5 mm	0.1 mm	97.1%
Translation C3-C4	< 3.5 mm	1.8 mm	48.6%
Translation C4-C5	< 3.5 mm	0.4 mm	88.6%
Translation C5-C6	< 3.5 mm	-0.5 mm	114.3%
Translation C6-C7	< 3.5 mm	-0.6 mm	117.1%
Translation C7-T1	< 3.5 mm	Not Digitized	n/a

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.

Angular Analysis	Patient Values
S Line	S2
C1-Horizontal	18.4º

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.

Normal Finding	Abnormal Finding
Endplate base lines converge	Endplate base lines are noted to be parallel or divergent at the following: C3

The vertebral base lines of the cervical spine, also known as segmental Cobb lines, are drawn to qualitatively assess for alignment. In this region the cervical alignment is normal when geometrically circular. Consequently, segmental Cobb/base lines that are drawn on the inferior endplate should converge posteriorly and be uniform from C2 through C7 levels. It is considered abnormal to note divergence or segmental Cobb lines that are parallel from C2-7.

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Radiographic Impression Report — Lateral Cervical Projection

Impressions and Assessment

The vertebral base lines of the cervical spine, also known as segmental Cobb lines, are drawn to qualitatively assess for alignment. In this region the cervical alignment is normal when geometrically circular. Consequently, segmental Cobb/base lines that are drawn on the inferior endplate should converge posteriorly and be uniform from C2 through C7 levels. It is considered abnormal to note divergence or segmental Cobb lines that are parallel from C2-7.

Mr. IMA Aiken has an S-line value of S2.

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Radiographic Impression Report — Lateral Cervical Flexion/Extension

Name: IMA Aiken **X-Ray was obtained: 10/13/2017** **Date of Digitization: 10/13/2017**
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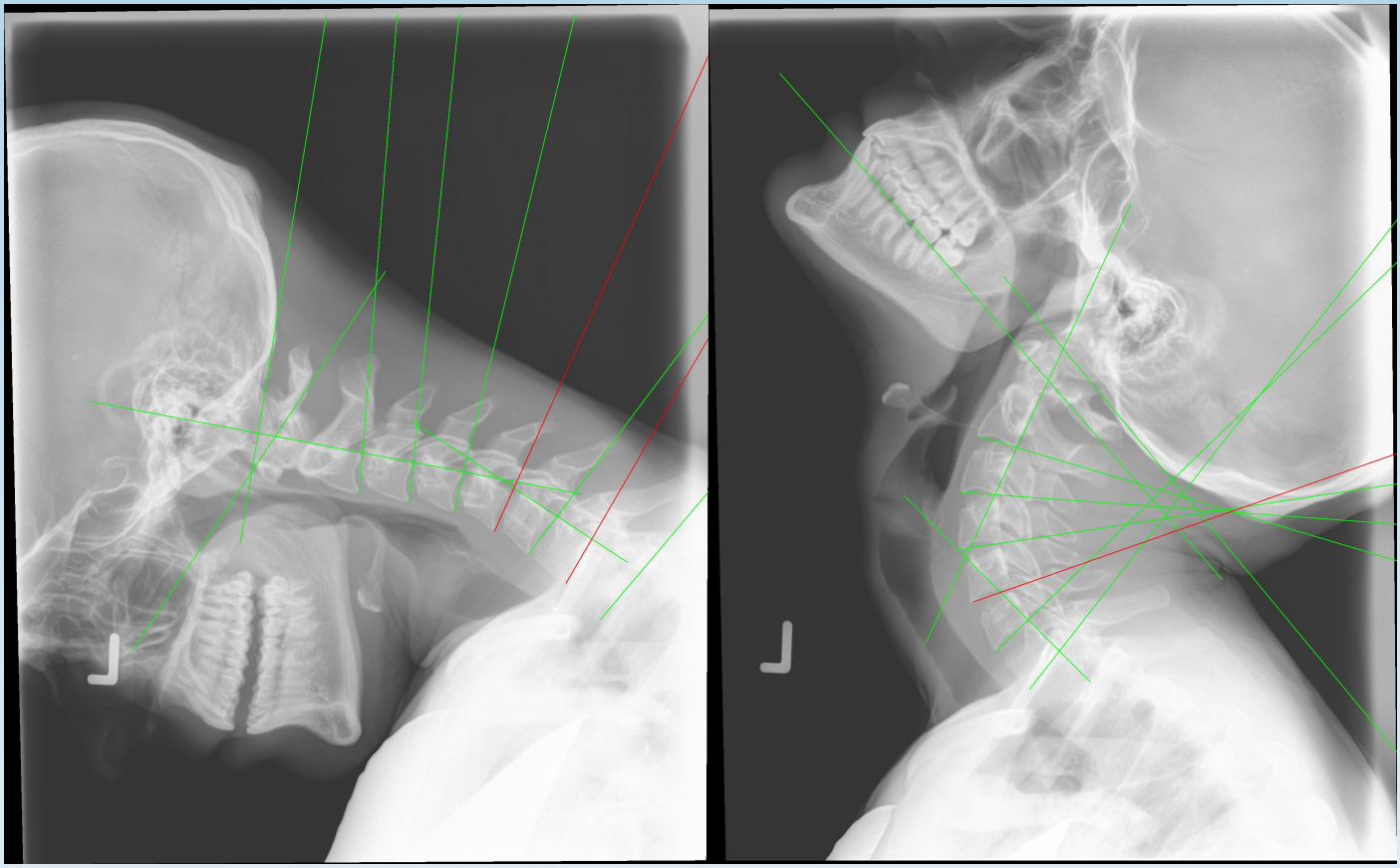
Flexion **Extension**



Anterior **PosteriorAnterior** **Posterior**

This red line represents the posterior tangent lines of mensuration and exceeds normal allowable segmental motion indicating ligament laxity.

This green line represents the posterior tangent lines of mensuration and appears to be stable with no significant ligamentous laxity.

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Radiographic Impression Report — Lateral Cervical Flexion/Extension

Flexion/Extension Values

Results	Normal Values	Flexion Values	Difference From Normal	Extension Values	Difference From Normal
Translation C2-C3	< 3.5 mm	0.2 mm	3.3 mm	-1.9 mm	1.6 mm
Translation C3-C4	< 3.5 mm	2.1 mm	1.4 mm	-2.2 mm	1.3 mm
Translation C4-C5	< 3.5 mm	0.8 mm	2.7 mm	-1.4 mm	2.1 mm
Translation C5-C6	< 3.5 mm	1.7 mm	1.8 mm	-1.6 mm	1.9 mm
Translation C6-C7	< 3.5 mm	0.5 mm	3.0 mm	-1.5 mm	2.0 mm
Translation C7-T1	< 3.5 mm	0.5 mm	3.0 mm	Not Digitized	n/a
Angle C2-C3	< 11.0º	1.3º	9.7º	-12.4º	1.4º
Angle C3-C4	< 11.0º	7.9º	3.1º	-12.7º	1.7º
Angle C4-C5	< 11.0º	10.5º	0.5º	-10.8º	0.2º
Angle C5-C6	< 11.0º	12.6º	1.6º	-24.8º	13.8º
Angle C6-C7	< 11.0º	-6.7º	4.3º	-7.8º	3.2º
Angle C7-T1	< 11.0º	10.1º	0.9º	Not Digitized	n/a
C2-7 angle	-42.0º	-22.5º	19.5º	-70.1º	28.1º

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	0.8	could indicate posterior dislocations, fractures of the odontoid process or ring of C1, or congenital abnormalities of the foramen magnum
Basilar Impression (Macrae's method)	n/a	WNL	WNL
Atlanto-Dental Interspace	≤ 3 mm	2.5 mm	WNL
Spinal Canal Diameter	> 13 mm	24.5 mm	WNL

WNL = Within Normal Levels

Upper Cervical Measurements - Extension	Normal Values	Patient Values	Clinical Significance
Powers Ratio	0.9 to 1	0.8	could indicate posterior dislocations, fractures of the odontoid process or ring of C1, or congenital abnormalities of the foramen magnum
Basilar Impression (Macrae's method)	n/a	WNL	WNL
Atlanto-Dental Interspace	≤ 3 mm	2.3 mm	WNL
Spinal Canal Diameter	> 13 mm	28.2 mm	WNL

WNL = Within Normal Levels

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Radiographic Impression Report — Lateral Cervical Flexion/Extension

Upper Cervical Measurements - Flexion + Extension	Normal Values	Patient Values	Clinical Significance
C0-C1 Instability	< 25º	5.2º	WNL
C1-C2 Instability	< 20º	16.0º	WNL

WNL = Within Normal Levels

Impressions and Assessment

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Radiographic Impression Report

AP Open Mouth

Name: IMA Aiken **X-Ray was obtained: 10/13/2017** **Date of Digitization: 10/13/2017**
Date of Birth: 1/2/1996

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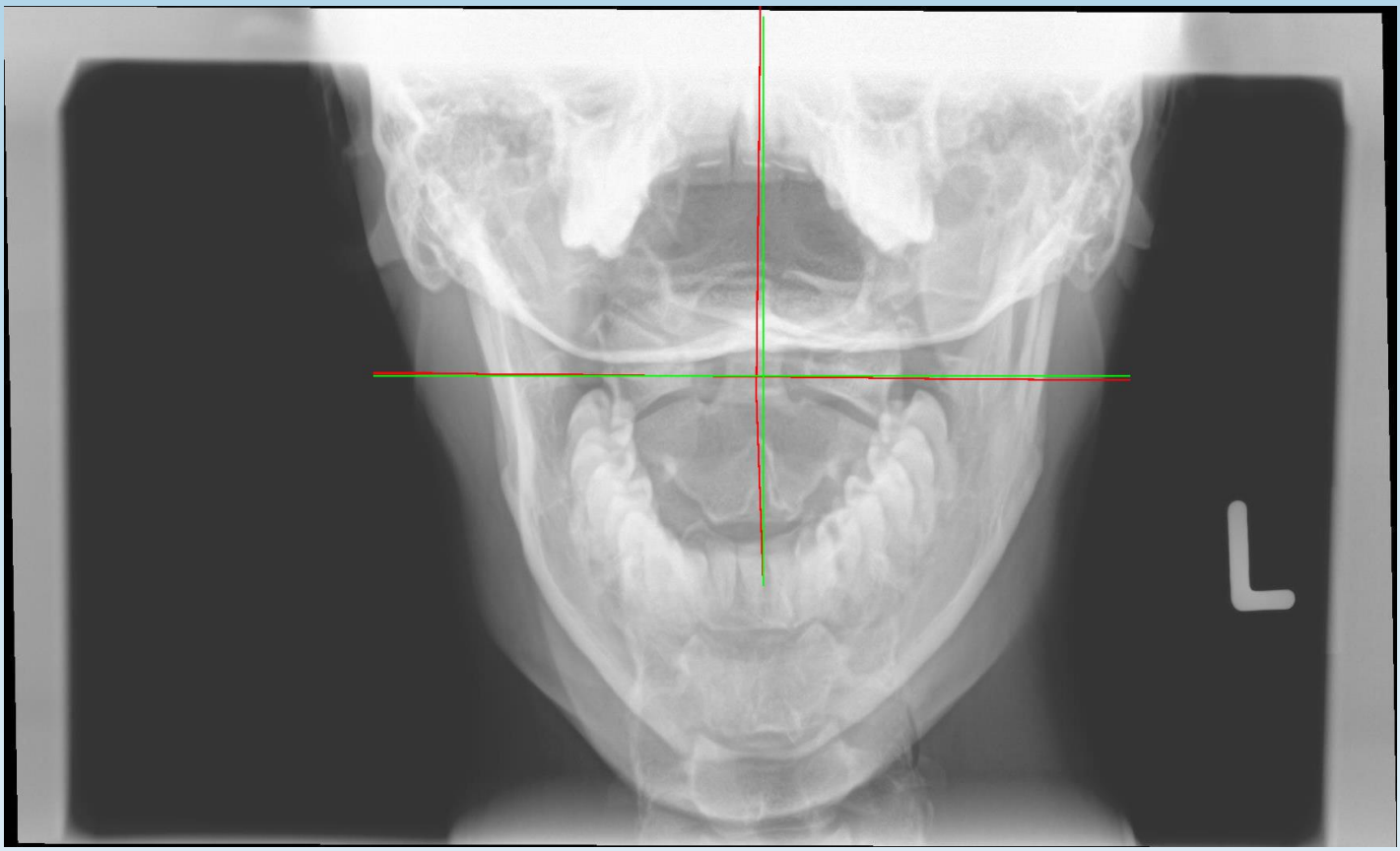

Right **Left**

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.

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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	0.1º	0.1º	WNL
C1-C2 Lat. Flex. Angle	0.0º	0.6º	0.6º	WNL
C2-C3 Lat. Flex. Angle	0.0º	3.1º	3.1º	WNL
Left C1-C2 "overhang" margin	0.0 mm	left 0.1 mm	0.1 mm	WNL
Right C1-C2 "overhang" margin	0.0 mm	right -1.8 mm	1.8 mm	WNL

WNL = Within Normal Levels

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Impressions and Assessment

As noted above in the table for the neutral position, Mr. IMA Aiken has a 0.1 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 1.8 mm right shift of C1 relative to the lateral body margin of C2.

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Radiographic Impression Report — AP Open Mouth Bending

Name: IMA Aiken **X-Ray was obtained: 10/13/2017** **Date of Digitization: 10/13/2017**
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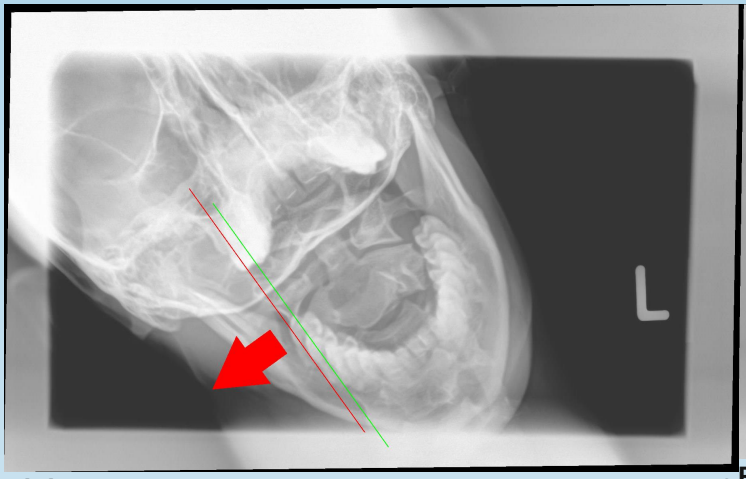
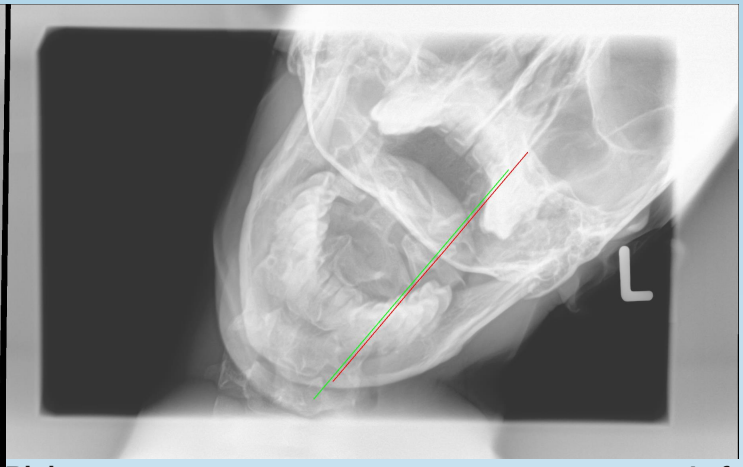
Right Lateral Flexion



Right Left

Left Lateral Flexion



Right Left

The red line represents the position of the atlas lateral mass in the side bending position.

The green line represents the position of the Axis superior articular process. Shifting of the red line from green greater than 3.0mm laterally indicates probable damage to the Alar and Accessory ligaments.

Left Cervical Bending Values

Global Analysis	Normal Levels	Patient Values	Clinical Significance
C0-C1 Lat. Flex. Angle	< 5.0º	1.9º	WNL
C1-C2 Lat. Flex. Angle	< 5.0º	0.8º	WNL
C2-C3 Lat. Flex. Angle	< 20.0º	1.4º	WNL
C1-C2 Overhang	< 3.0 mm	left 1.2 mm	WNL
C2 Axial Spinous Rotation	< 10.0º *	right 8.5º	WNL

WNL = Within Normal Levels

* Some research indicates some subjects can have up to 14º of C2 spinous rotation with a large lateral bending of C2 on C3 but most research indicates C2 Spinous rotation of less than 10º as an upper limit.

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.

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Right Cervical Bending Values

Global Analysis	Normal Levels	Patient Values	Clinical Significance
C0-C1 Lat. Flex. Angle	< 5.0º	2.4º	WNL
C1-C2 Lat. Flex. Angle	< 5.0º	1.9º	WNL
C2-C3 Lat. Flex. Angle	< 20.0º	0.9º	WNL
C1-C2 Overhang	< 3.0 mm	right -3.9 mm	Possible Instability
C2 Axial Spinous Rotation	< 10.0º *	left 12.2º	Possible Instability

WNL = Within Normal Levels

* Some research indicates some subjects can have up to 14º of C2 spinous rotation with a large lateral bending of C2 on C3 but most research indicates C2 Spinous rotation of less than 10º as an upper limit.

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

For the left position, Mr. IMA Aiken has a C1-C2 Left Translation of 1.2 mm and a C1-C2 Right Translation of 0.8 mm. Relative to the neutral position, a C2 Axial Rotation of 8.5º was observed.

For the right position, Mr. IMA Aiken has a C1-C2 Left Translation of -2.4 mm and a C1-C2 Right Translation of -3.9 mm. Relative to the neutral position, a C2 Axial Rotation of 12.2º was observed.When the patient bends to the right there is movement of 3.9 mm. This displacement overhang of C1 on C2 indicates possible unilateral damage of the Alar and/or Accessory Ligaments.

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Radiographic Impression Report

AP Cervical Projection

Name: IMA Aiken **X-Ray was obtained: 10/13/2017** **Date of Digitization: 10/13/2017**
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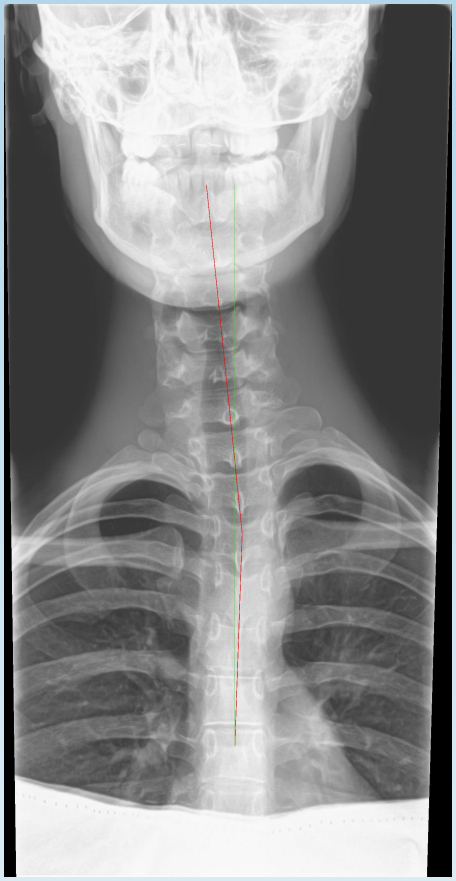
Spinal Biomechanics Compared to Normal

Global Analysis	Normal Values	Patient Values	Difference From Normal
RZA T7	0º	-2.0º	2.0º
CDA C2-T7	0º	7.7º	7.7º
Translation C2-T7	0 mm	-12.5 mm	12.5 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

As noted above in the table, Mr. IMA Aiken's cervical spine is translated (listed) from plumb by 12.5 mm to the right. Of importance is that the patient has a mid neck abnormal angle of 7.7 degrees to the right. The patient has an angular displacement from normal (plumb) of the lower cervical and upper thoracic spine of 2.0 degrees to the left.

Roderic Rochester, DC, FCCJP

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Radiographic Impression Report

Nasium Cervical/Thoracic Projection

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Date of Birth: 1/2/1996

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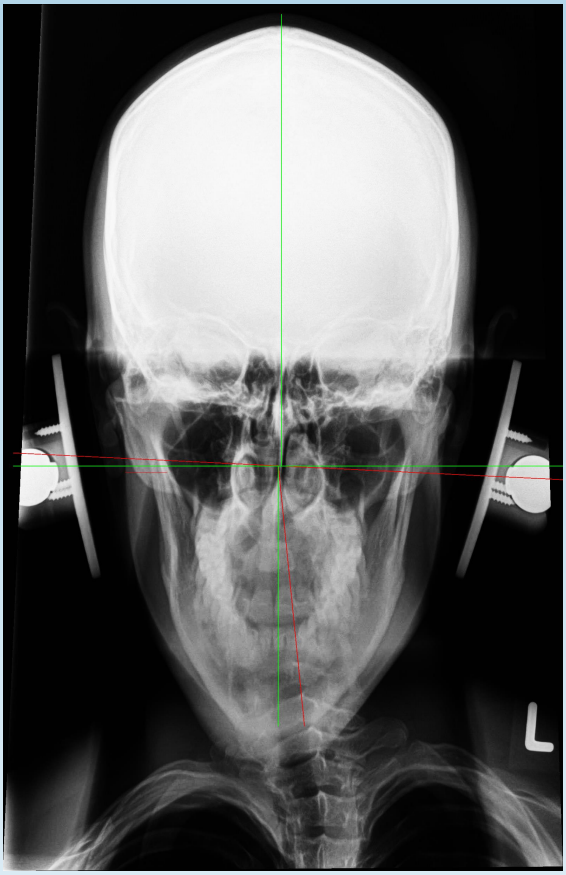
Spinal Biomechanics Compared to Normal

Global Analysis	Normal Values	Patient Values	Diff. From Normal
Head Tilt	0º	0º N	0.0º
Plane Line	0º	2.75º R	2.8º
Upper Angle	0º	2.75º R (81.5º)	2.8º
Condyle Circle	n/a	3In.	n/a
Axial Circle	n/a	8in.	n/a
Lower Angle	0º	8.5º L (81.5º)	8.5º

Impressions and Assessment

Mr. IMA Aiken's spine denotes an upper angle measurement of 2.75º on the right and a lower angle of 8.5º to the left side, Ideal alignment in this region of the upper cervical spine should approximate 0º of offset of the upper angle and the lower angle - meaning the skull would positioned perpendicular to the Atlas bone (C1).



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.

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Radiographic Impression Report — Vertex

Name: IMA Aiken **X-Ray was obtained: 10/13/2017** **Date of Digitization: 10/13/2017**
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Right **Left**

The green line represents the patient's alignment on the Vertex/Base Posterior.

The red line represents the patient's alignment on the Vertex/Base Posterior with some abnormality.

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Radiographic Impression Report — Vertex

Spinal Biomechanics Compared to Normal

Results	Normal Values	Patient Values	Difference From Normal
Rotation at C1	0.0º	posterior 2.5º	2.5º

Impressions and Assessment

As noted above in the table, Mr. IMA Aiken has a posterior atlas rotation of 2.5 degrees.