Mechanical Spine Pain
Seven Common Spinal Distortion Patterns, Causes and Correction

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Introduction

Spine Mechanics

- The human skeleton is designed to resist the force of gravity in an upright vertical position. It also provides for locomotion by muscle contraction and joint design
- The ligament system stabilizes and maintains joint alignment.
- The disc acts as a flexible coupling to transfer forces from motion segment to segment.
- The spine and pelvis is a multi-component mechanical system of alternating hard and soft tissue. That makes the system semirigid and elastic.
- Segmental, regional and global measurements of the spine can be combined to assess its structural and functional efficiency.
- Distortion of the spinal system is predictable to the motions of walking.

Clinical Procedures

- The spine-pelvic system compensates to injury into a non-neutral position of gait
- The patient spine is analyzed and compared to the mechanical and functional organization of an optimum spine in a non-neutral position of gait.
- The treatment goal is to re-organize the spine to normal organization of gait.
- This goal moves the patient toward optimum structural and functional integrity
- As the spine is reorganized mechanical spine pain is reduced or iliminated

- Treatment includes
  - Specific 3D spinal adjusting
    - Drop table
    - Multiple impulsing instruments
    - Flexion distraction
    - Blocking
  - Specific unilateral exercise

Results of Treatment Based on Biomechanical Analysis

Study: 580 consecutive patients

Reporting: patients reported initial pain as **SEVERE**

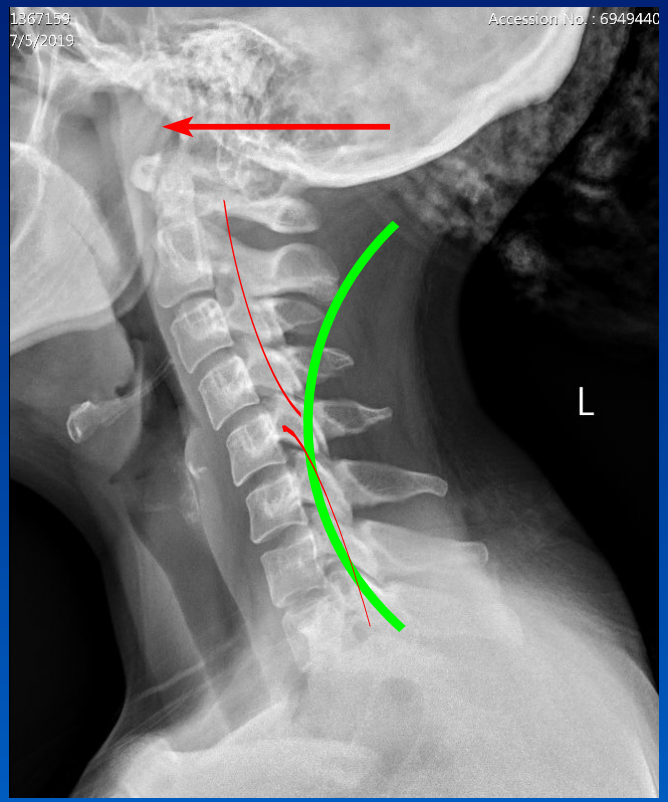
after 10 treatments the majority of patients reported pain as **MINIMUM**

Pain Level Beginning	Pain Level Present	Pain Level	Description of Pain and Dysfunction
		Absent	Pain is totally absent
	X	Minimal:	Present but forgotten with activity
		Mild:	Annoying but doesn't interfere with activity
		Moderate:	Pain requires modification of activity
X		Severe:	Unable to perform normal duties due to pain
		Very Severe:	Causes you to cry out in pain

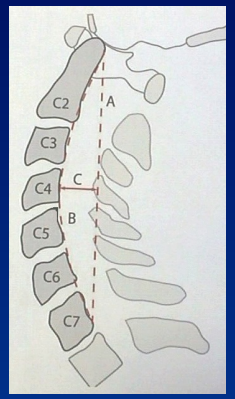
Spine System Destabilization

Cervical Injury and Forward head Posture

- Injury to the cervical spine is observed by **abnormal geometry** in almost all musculoskeletal complaints including neck, shoulder and low back pain. A physical finding of this injury is strightening of the curve with **forward head displacement**
- Cervical curve injury can result from **sudden impacts** like a simple falling down or a motor vehicle accident
- When injured, the cervical curve becomes two distinct upper and lower curves



Most Common Spine Injury



Normal
Neutral

13 YO F
scoliosis

79 YO F
lumbar disc

17 YO M
Scoliosis

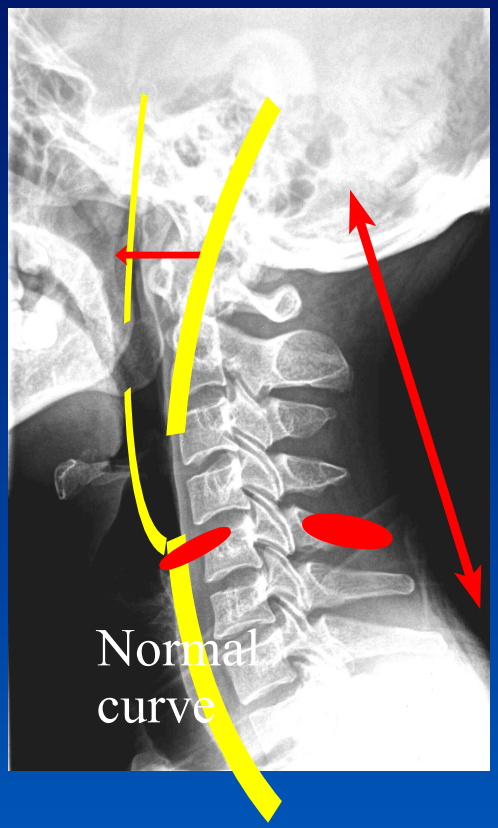
43 YO M
lumbar Disc

More than 95% of all patients with acute and chronic pain have injury to the cervical curve

13 YO F neck
shld , lbp

Pain Symptoms Common to Injured Cervical Curve

Injury to C4/5 interspinous ligament



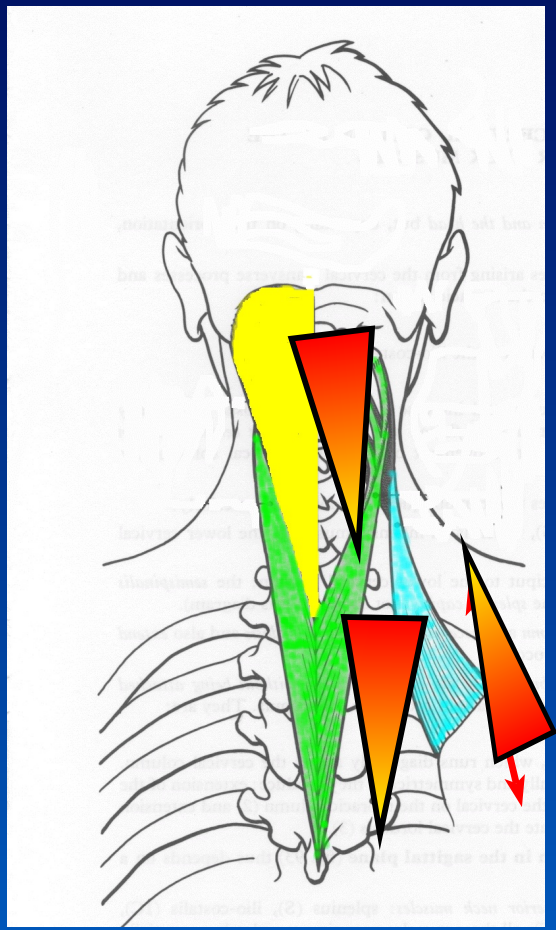
Loss of cervical curve and head goes anterior

Stretches splenius capitus and cervicus ms

Pulls on origin and insertion causing pain

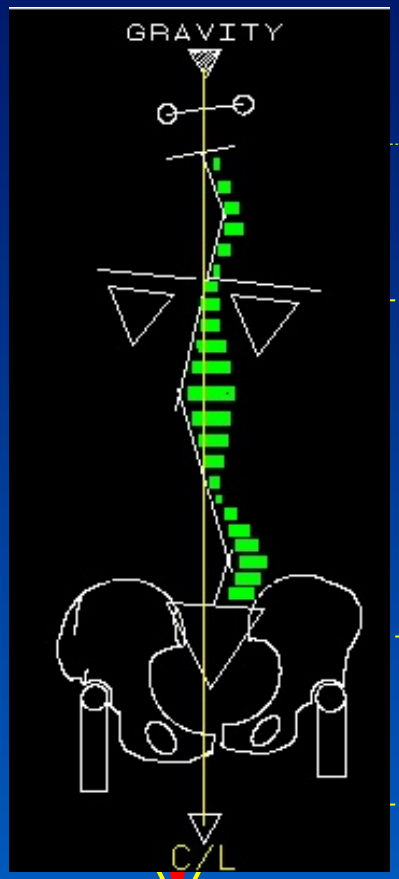
Stretches levator scapula causing pain

Abnormal disc and joint loading



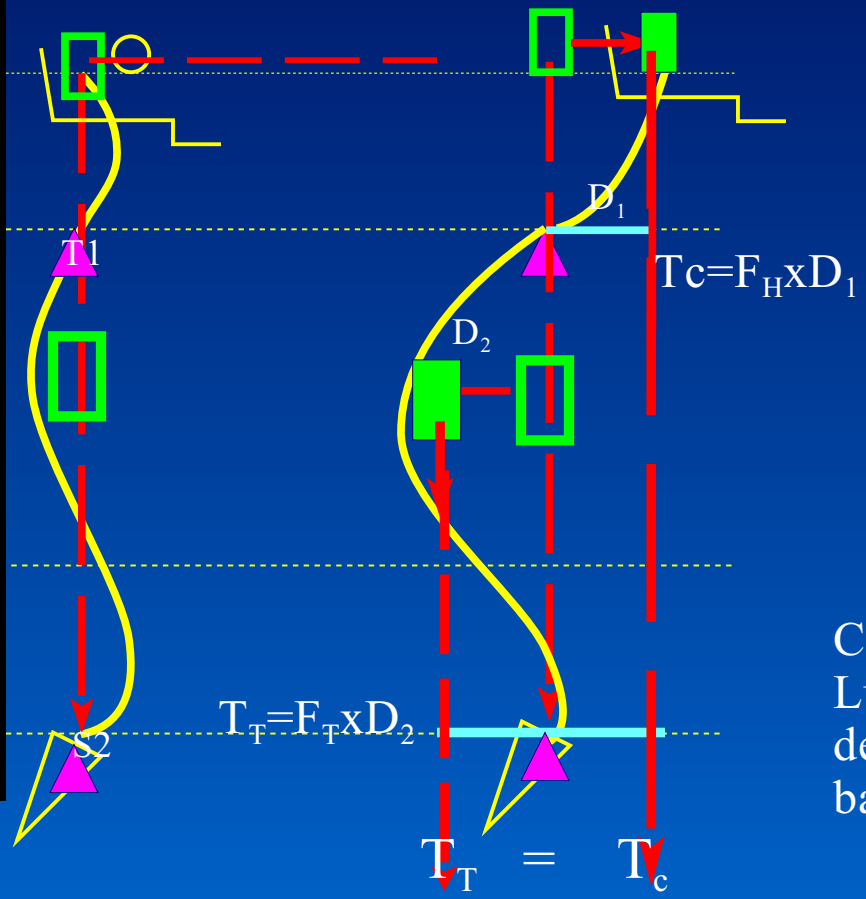
Reactive compensation in the thoracic, lumbar and pelvic regions .

3D Compensation Rebalances the Spine by Displacement of Masses and Muscle Contraction



Optimum Compensation

With cervical injury center of gravity / mass of head moves forward



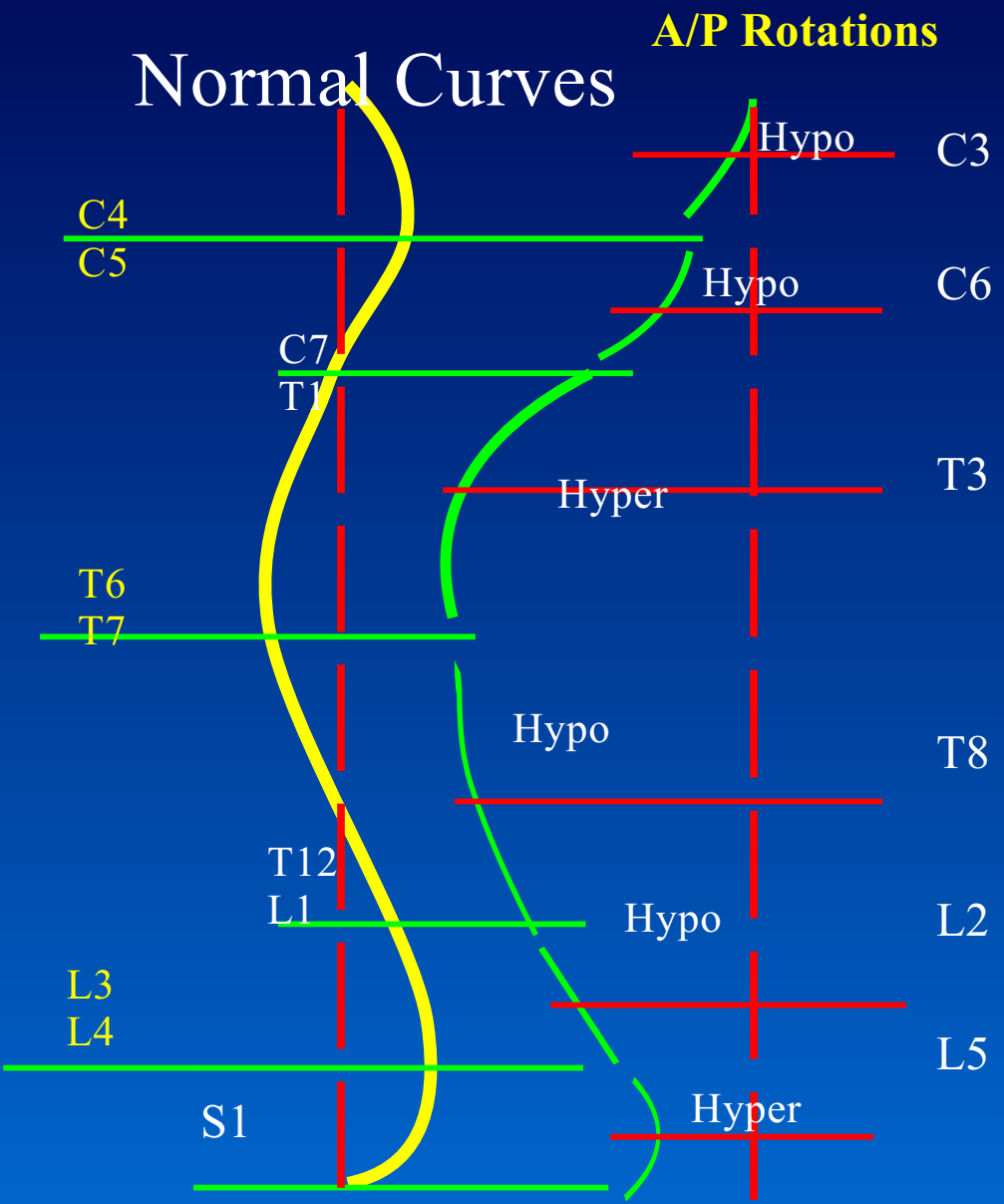
This creates unbalanced torque at T1 and S2
Cervical, lumbar and pelvic extensors activated

This results in forced compensation in the frontal plane to balance the system. This includes torso rotation, lumbar extension and pelvic coupling to a non-neutral position of gate.

The torso center of mass moves backwards

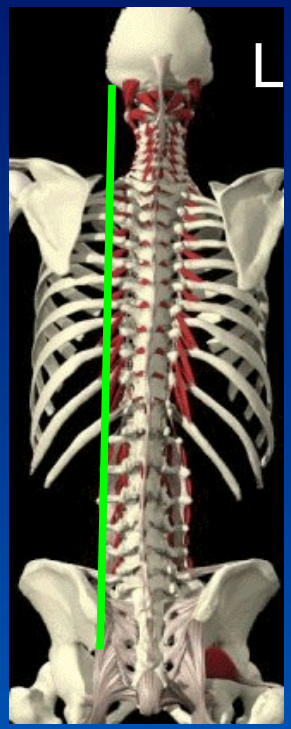
Creates opposite torque around S2. Lumbar and pelvic extensors are deactivated and the spinal system is balanced .

Breakdown of the Sagittal Curves

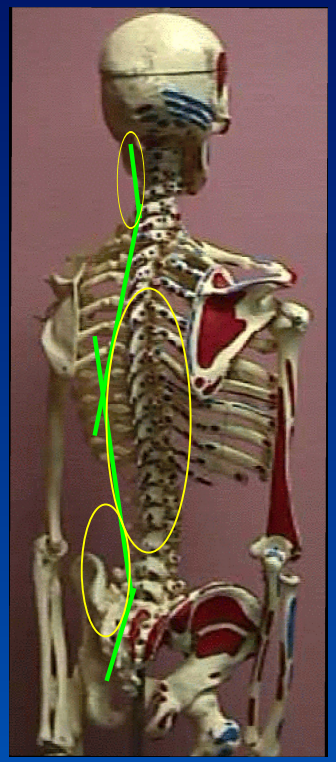


- When the normal sagittal curves are intact the highest loading occurs at the apex of the curves C4/5, T6/7 and L3/4
  - Neutral A/P position maintained by ligament integrity
- When the sagittal curves breakdown the highest loading is at the mid point of the altered curves
  - C3, T3, T8, L2, L5
- In the frontal plane the vertebra rotate to stabilize the loss of joint stability.

Regional and Global Geometry of the Compensated Spine due to Torso Rotation



Neutral Optimum



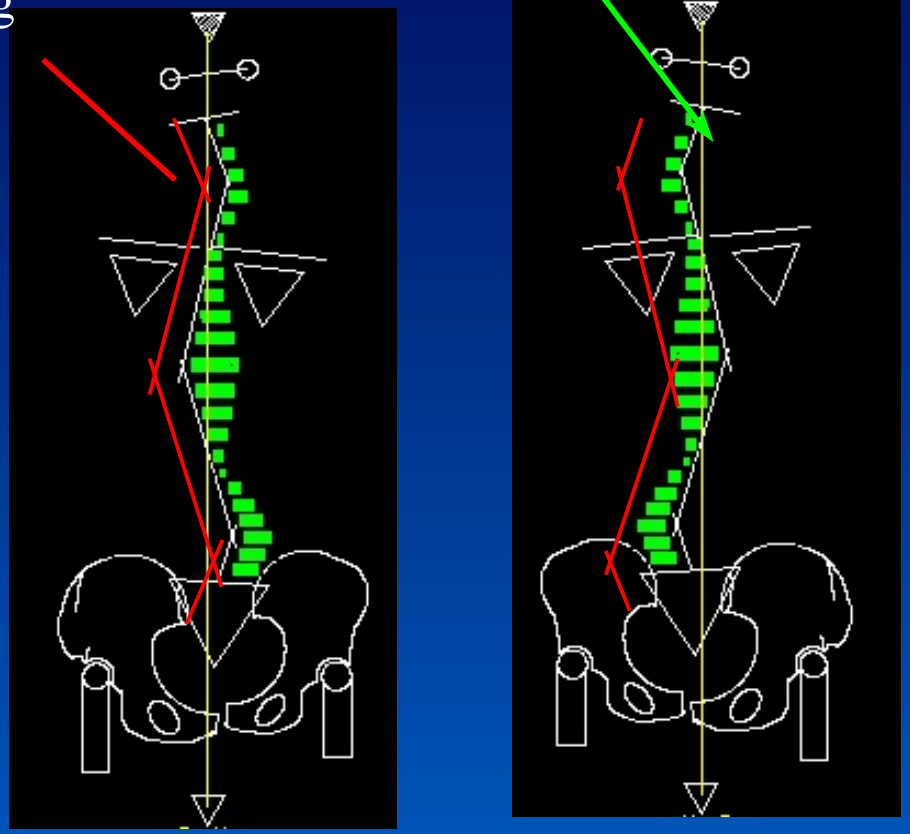
Compensatory Torso Rotation

Projected Frontal Plane

- On x-ray the effects of right torso rotation produces a **projected image of a balanced scoliosis**
- This occurs as the sagittal plane spinal curves **project** into the frontal plane
- The x-ray image demonstrates **organized geometry region to region.** (reciprocating lateral bends)
- The organized geometry of the compensatory spine provides an **optimum reference** for patient comparison .

Organized Geometry of the Optimum Spine

- On x-ray the compensatory spine demonstrates full geometric organization from left or right torso rotation
  - There are reciprocating lateral bends in the (C,T,L) regions
  - The vertebral body rotations are
    - All on one side
    - Have increasing and decreasing amplitude within each spinal region
  - The head is balanced over the sacrum
- The geometric organization is a direct measure of the mechanical efficiency of the spine .

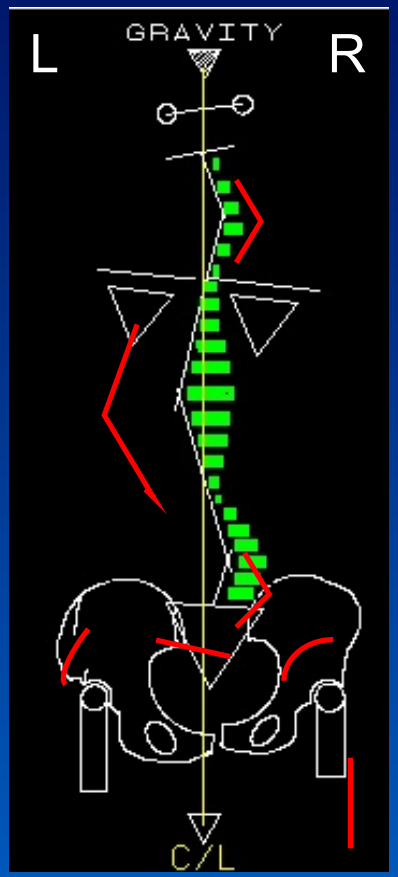


Right torso rotation

Left torso rotation

Biomechanical and Physical Findings of Organized Compensation

Right Compensatory Pattern Associated with Right Torso Rotation and coupled motions of Gait



Right inferior sacrum

Right ilium rotated posterior (PI)

Resulting in functional right short leg

Left ilium rotated anterior (AS)

Right lumbar convex curve with right vertebral body rotations

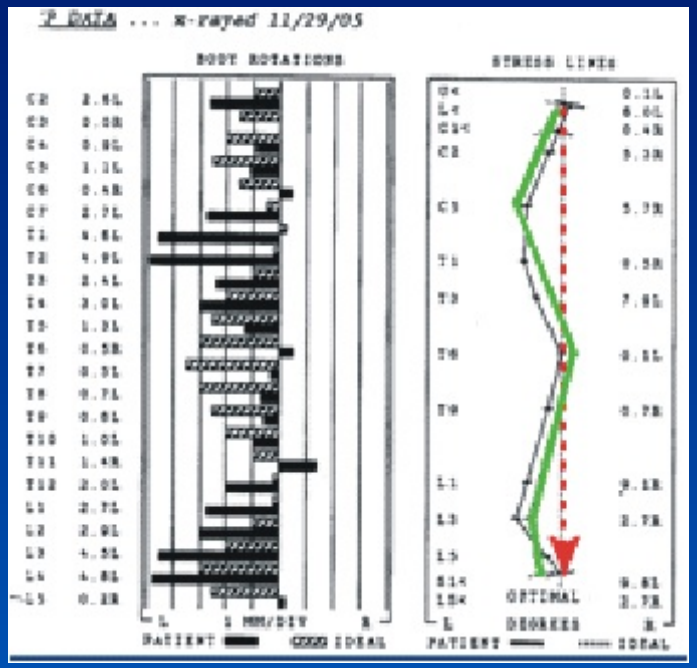
Left thoracic convex curve with right vertebral body rotations

Right cervical convex curve with right vertebral body rotations

These geometric characteristics and physical findings will be compared to the patient to assess spinal organization and to determine specific spinal adjustments .

Seven Common Frontal Plane Distortion Patterns

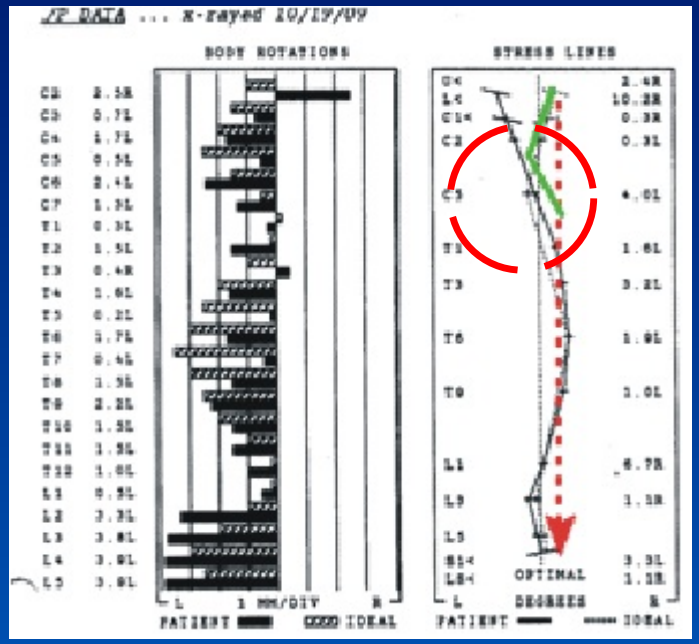
#1 Ideal Compensation of AP Stress Lines C,T,L

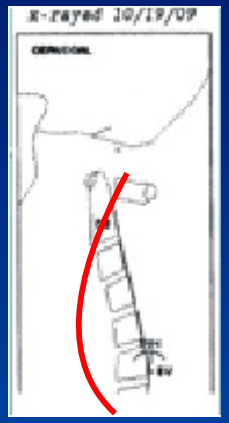


- Patient has regional and global organization of the AP stress lines.
  - The cervical, thoracic and lumbar curves are intact and project an ideal organized left rotation pattern.
- The VBR graphing identifies multiple levels of abnormal coupling. C3, C6-T3, T6-T9, T11 and L5.

#2 Cervical: Stress Lines Reversed

Pattern 2

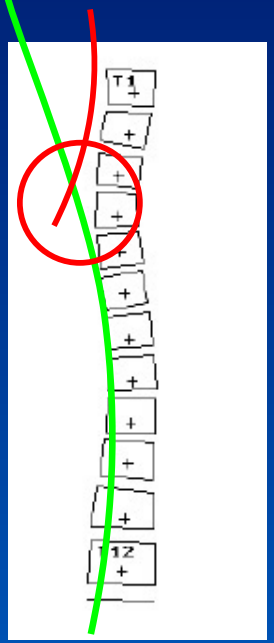




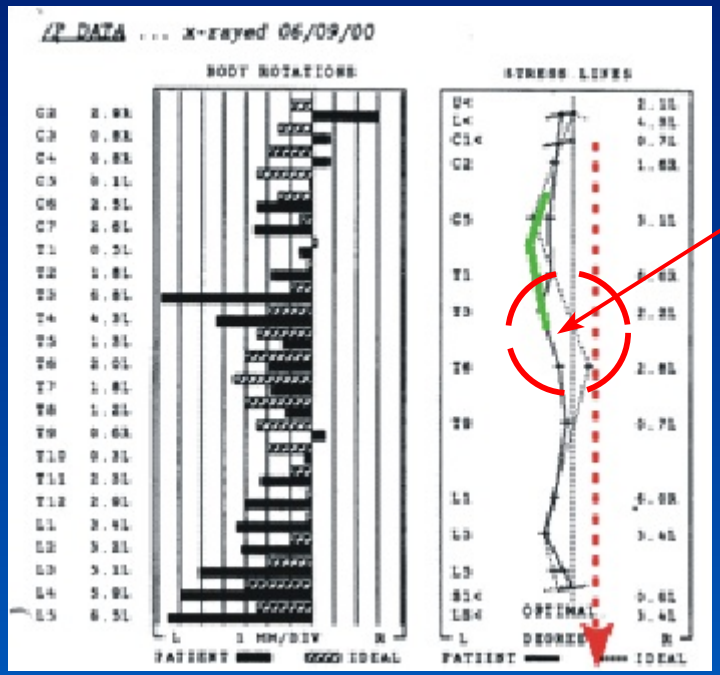
- There is a mismatch of the AP stress lines in the cervical region in comparison to a left, ideal compensation pattern. (Correct cervical stress lines highlighted in green.) Patient matches thoracic and lumbar regions
- This finding is the result of a reversed cervical curve which cannot project the correct lateral bend.
- There is motion segment uncoupling at C2, C5, T1, T3, T5, T7. There are excessive VBR rotations L2-L5.

#3 Upper Thoracic: Abnormal Lateral Bend at T1-T3

Ideal compensatory path

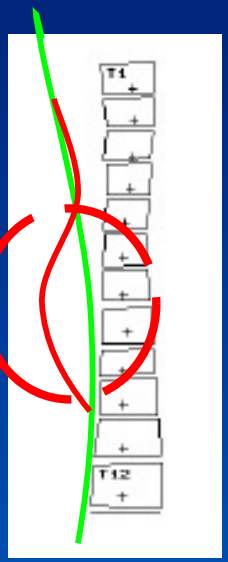


Pattern 3

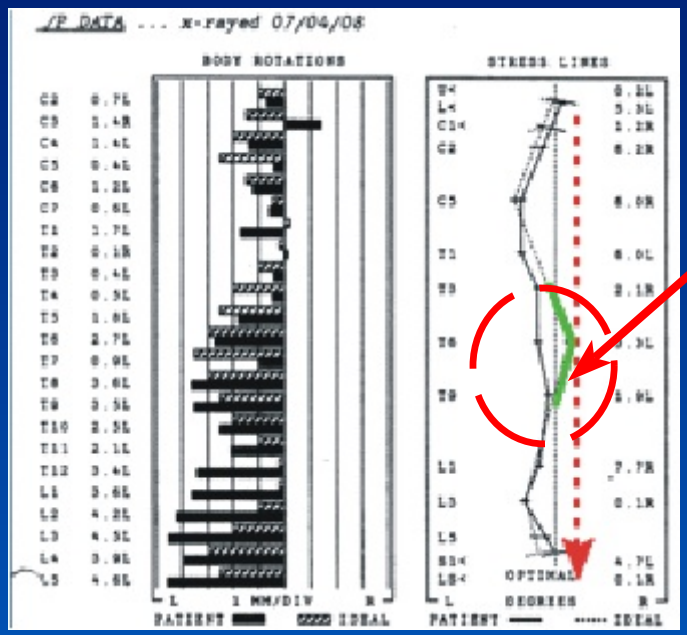


- The upper thoracic stress line T1-T3 suddenly bends to the right at T3. This is a lateral collapse of the upper thoracic region.
- There is motion segment uncoupling particularly at C2-C5, C7, T3, T4, T9.
- T11-L5 demonstrate excessive VBR.

#4 Mid Thoracic: Abnormal Lateral Bend at T3-T9



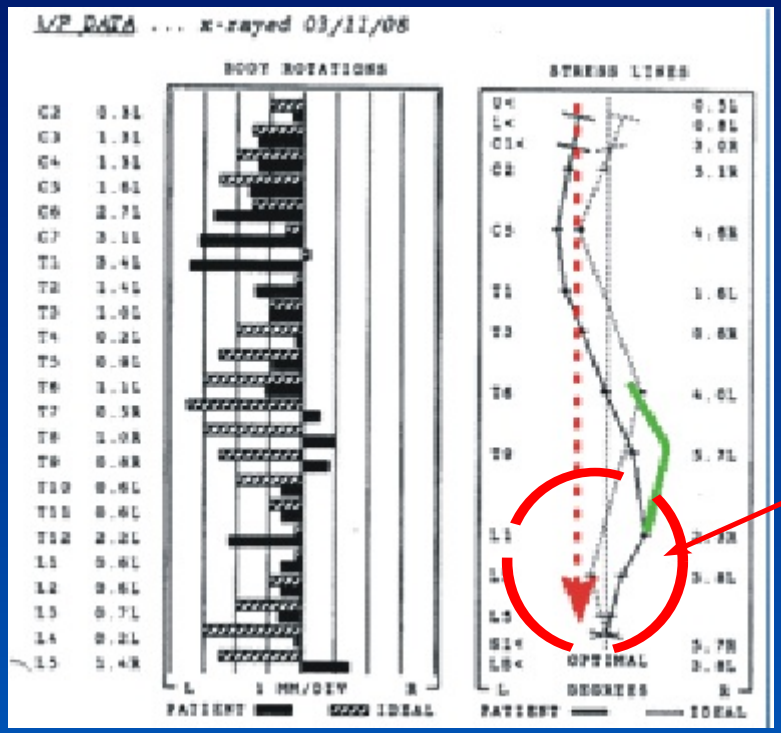
Pattern 4



- There is a reversal of the mid thoracic region T3-T9. This is usually associated with a backwards fall with the impact centered at T6.
- There is motion segment uncoupling at C3, C5, T1-T4, T7. There are excessive VBR T12-L5.

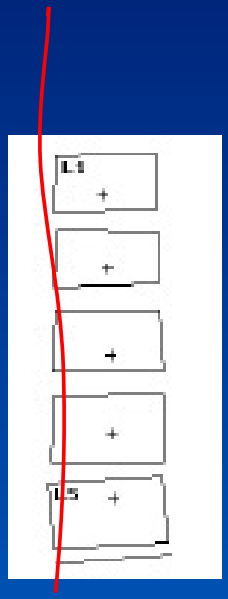
#5 Lower Thoracic: Abnormal Lateral Bend T9-T12

Pattern 5

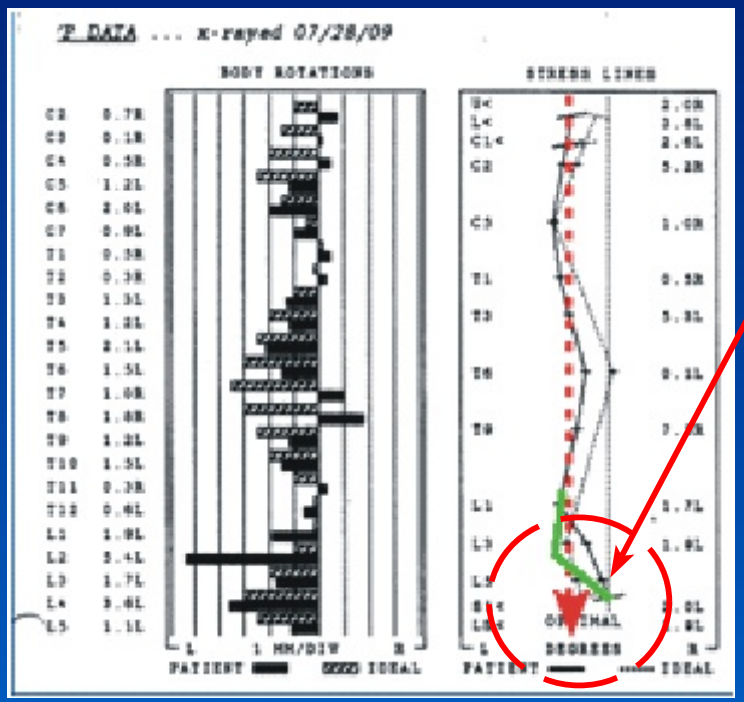


- There is a reversal of the lower thoracic region at T12/L1. The normal inflection point is T6, the apex of the thoracic curve.
- There is motion segment uncoupling at C6-T1, T4, T12, reversed rotations T7-T9 and L5

#6 Lumbar: Abnormal Lateral Bend L1-L5



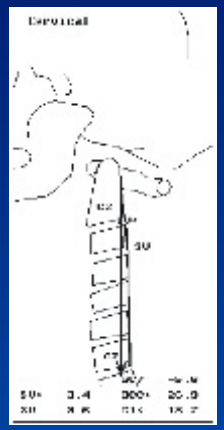
Pattern 6

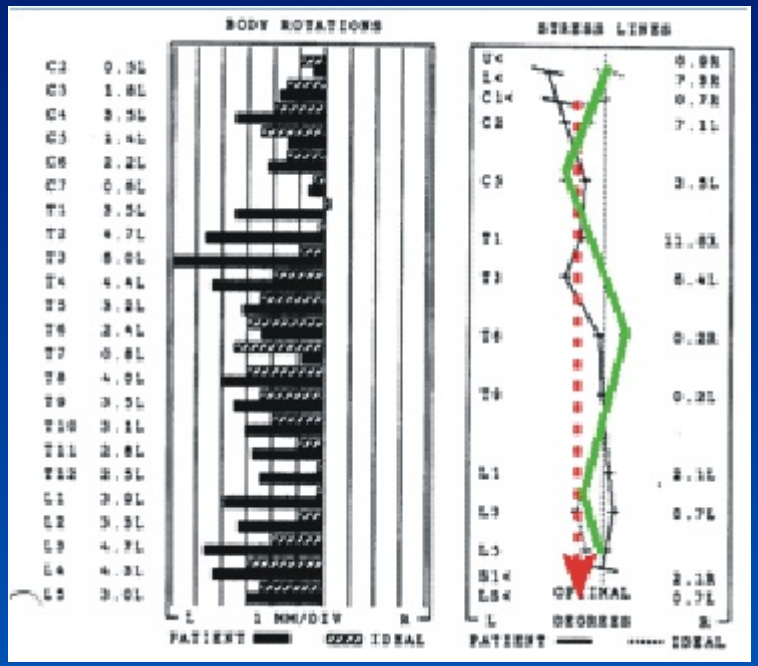


- The lumbar region is reversed L1-L5 in comparison to the ideal compensatory pattern.
- There is motion segment uncoupling at C2-C4, T2, T7, T8, L2 and L5.

#7 Full Spine: Abnormal Bending Throughout the Spine

Pattern 7

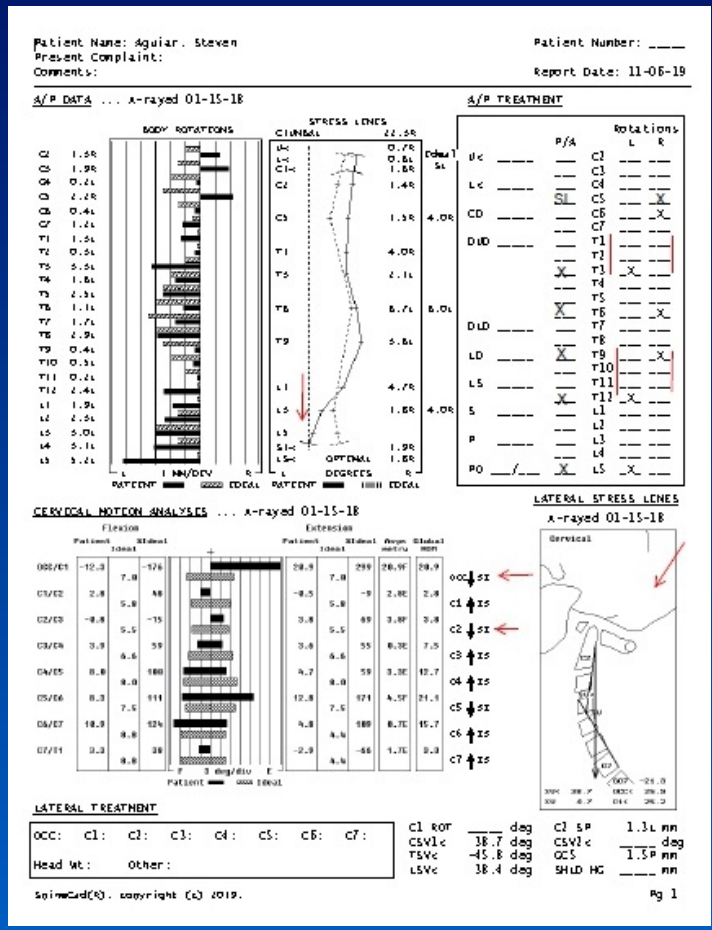




- There is abnormal lateral bending in all regions of the spine
- There is motion segment uncoupling at VBR T1-T4, T7 and L1.
- Multiple reversals of the AP stress lines indicate ligament injury and instability throughout the entire spine system.

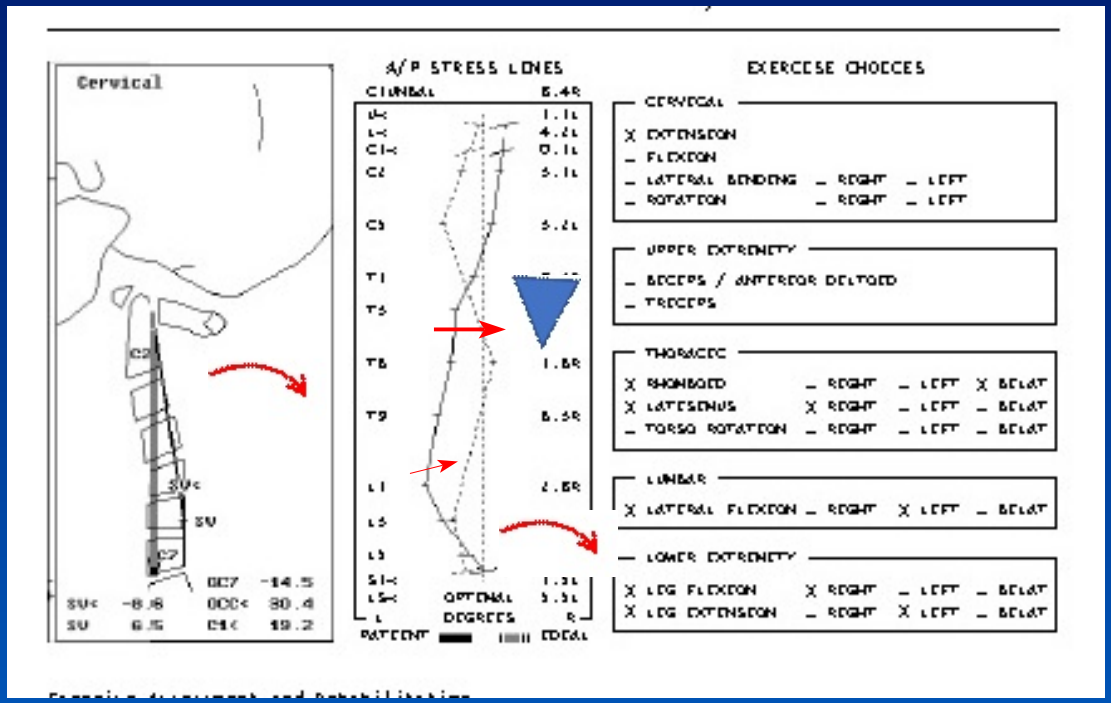
Clinical Process

- Patient gets spinal x-rays for the cervical, thoracic and lumbo-pelvic regions.
- X-rays are processed to produce spinal geometry
- Patient geometry is best-matched to a left or right compensatory pattern.
- Spinal geometry is summarized to produce a Treatment Card
- Treatment and rehabilitation is determined from the spinal analysis



Exercise Rehabilitation based on Spinal Geometry and Clinical Goals

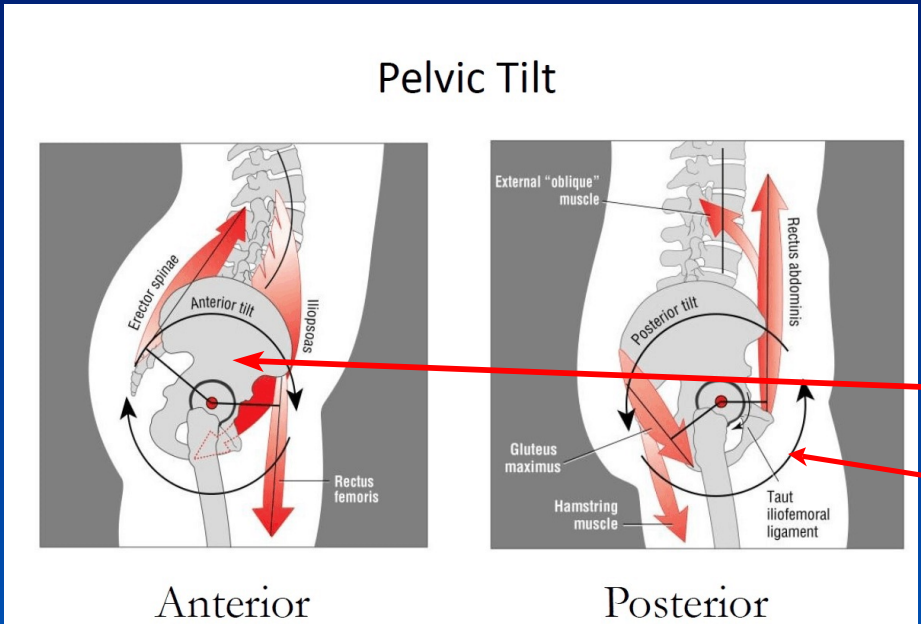
Unilateral Exercises Assist in Spinal Correction



- Cervical extension
- Rhomboid on right
- Latissimus Dorsi on right
- Lumbar lateral bending
- Pelvis
  - Leg flexion right
  - Leg extension left

Correcting Pelvic Rotation

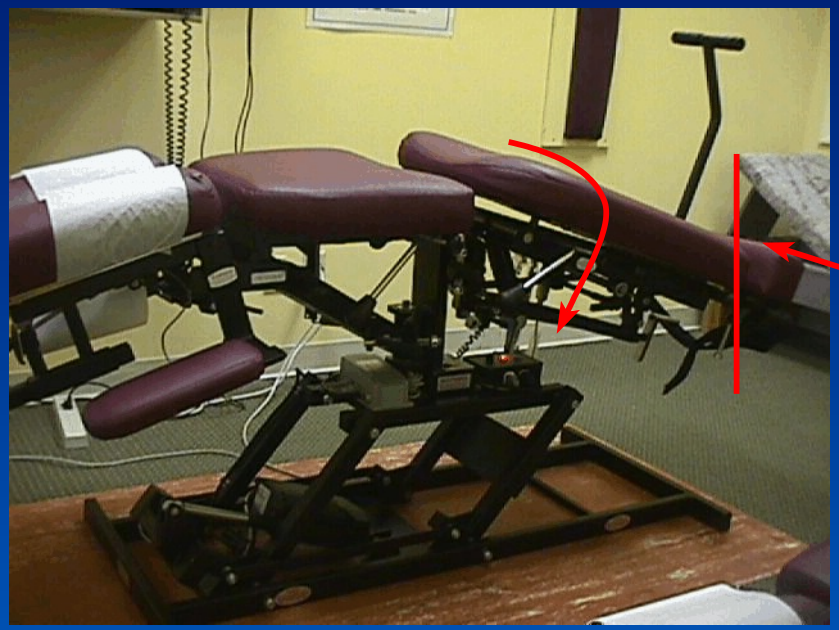
Specific exercise complements spinal adjusting



- Abnormal pelvic position includes
  - Ilium posterior PI
  - Ilium anterior AS
- Muscle action can be used to assist the adjustment to reposition, strengthen and stabilize the pelvis
- Pelvis PI
  - Correct with quadruceps femoris
- Pelvis AS
  - Correct with hanstring

Spine Pelvis Adjusting

Clinical Example

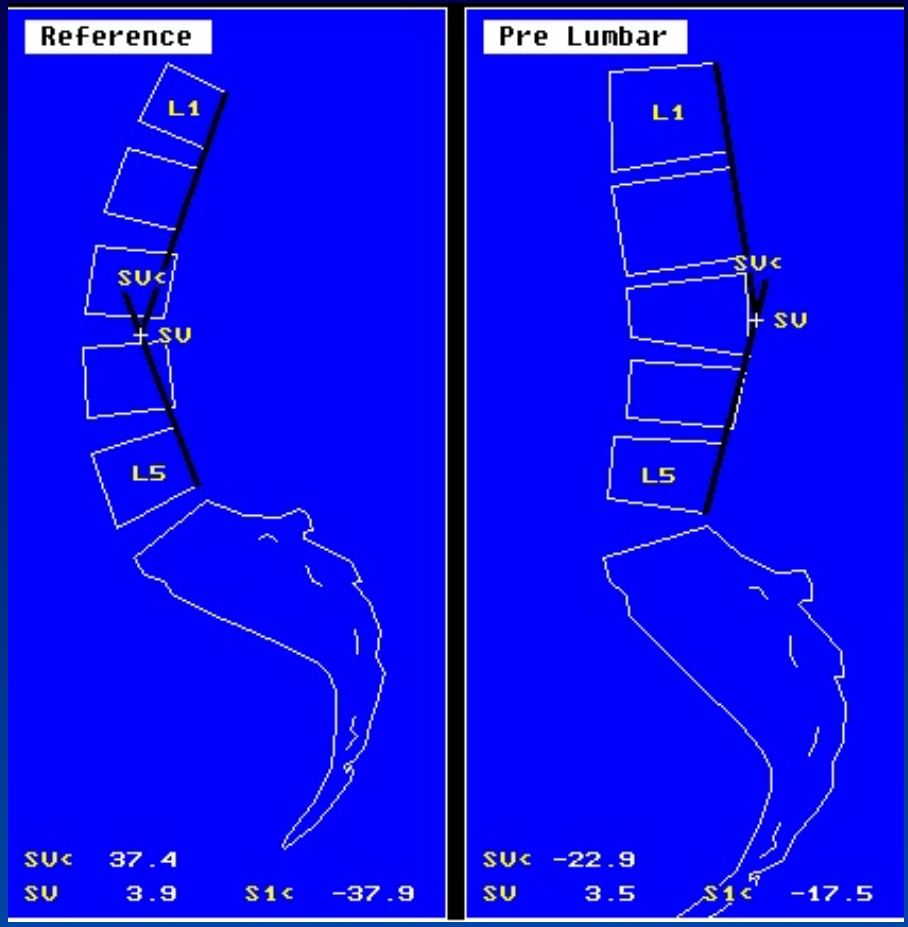


- Patient lays face down on the adjusting table
- Table is positioned to place patient in ideal compensatory pattern.
- Table position may include
  - flexion distraction of lumbar spine
  - Rotation of lumbar spine and pelvis
  - Lateral bending of lumbar spine

Clinical Examples

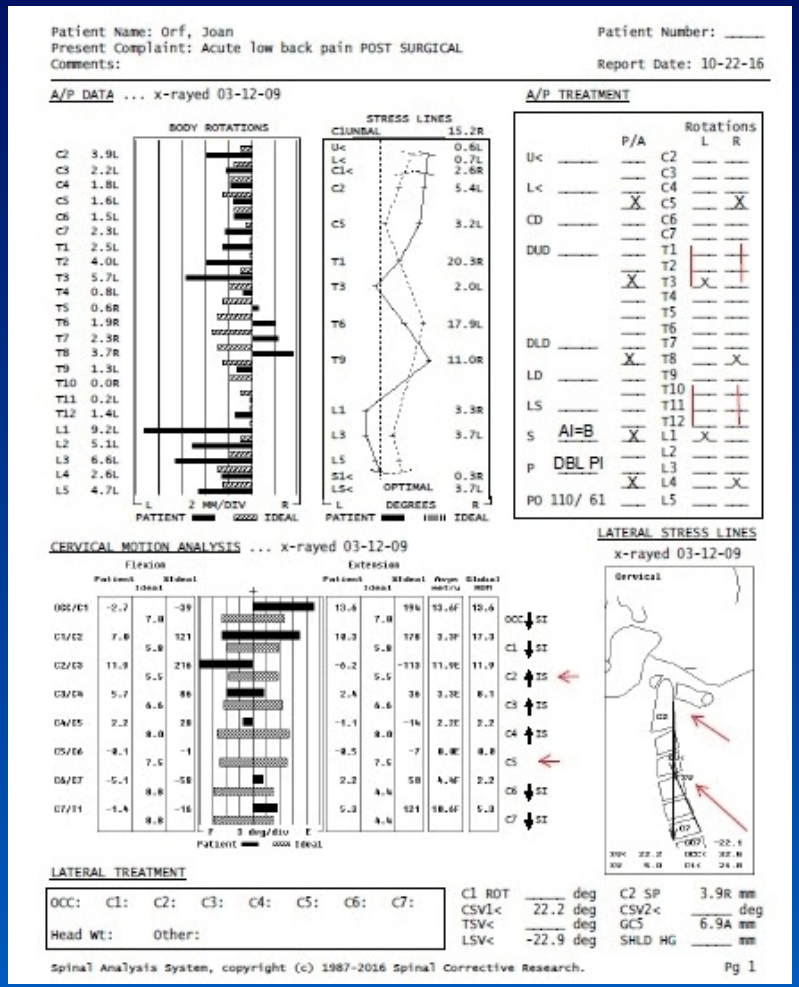
- 73 yo female
- Two surguries L4, L5 discectomies
  - Post surgical foot drop
  - Over twentyfive post surgical injections
- 2 years continuous severe low back pain following surgury. Pain rated at 8/9 Confined to walker
- Unable to do any acticities of daily living (ADL)
- Told by surgeon to learn to live with pain

- Severe lumbar degenerative disc disease
- Severe lumbar stenosis
- Stuctural and degeneratve scoliosis
- Reversed lumbar curve from vertebral collapse



Orf, Joan

Structural and Degenerative Scoliosis


Patient Name: Orf, Joan
Present Complaint: Acute low back pain POST SURGICAL
Comments:
Patient Number: _____
Report Date: 10-22-16

A/P DATA ... x-rayed 03-12-09

BODY ROTATIONS

C2	3.9L
C3	2.2L
C4	1.8L
C5	1.6L
C6	1.5L
C7	2.3L
T1	2.5L
T2	4.0L
T3	5.7L
T4	0.8L
T5	0.6R
T6	1.9R
T7	2.3R
T8	3.7R
T9	1.3L
T10	0.0R
T11	0.2L
T12	1.4L
L1	9.2L
L2	5.1L
L3	6.6L
L4	2.6L
L5	4.7L

L 2 MM/DIV R
PATIENT IDEAL

STRESS LINES
C1UNBAL 15.2R

U<	0.6L
L<	0.7L
C1<	2.6R
C2	5.4L
C5	3.2L
T1	20.3R
T3	2.0L
T6	17.9L
T9	11.0R
L1	3.3R
L3	3.7L
L5	
S1<	0.3R
LS<	3.7L

OPTIMAL
L DEGREES R
PATIENT IDEAL

A/P TREATMENT

		P/A		Rotations L	Rotations R
U<	_____	____	C2	____	____
		____	C3	____	____
L<	_____	____	C4	____	____
		X	C5	____	X
CD	_____	____	C6	____	____
		____	C7	____	____
DUD	_____	____	T1	____	____
		____	T2	____	____
		X	T3	X	____
		____	T4	____	____
		____	T5	____	____
		____	T6	____	____
DLD	_____	____	T7	____	____
		X	T8	____	X
LD	_____	____	T9	____	____
		____	T10	____	____
LS	_____	____	T11	____	____
		____	T12	____	____
S	AI=B	X	L1	X	____
		____	L2	____	____
P	DBL PI	____	L3	____	____
		X	L4	____	X
PO	110/ 61	____	L5	____	____

CERVICAL MOTION ANALYSIS ... x-rayed 03-12-09

Flexion / Extension

	Flexion Patient	Flexion Ideal		Extension Patient	Extension Ideal	Range motion	Ideal ROM	
OCC/C1	-2.7	7.0	-39	13.6	7.0	99%	13.6F	13.6
C1/C2	7.6	5.0	121	10.3	5.0	178	3.3F	17.3
C2/C3	11.9	5.5	216	-6.2	5.5	-113	11.9E	11.9
C3/C4	5.7	6.6	86	2.4	6.6	36	3.3E	8.1
C4/C5	2.2	8.0	28	-1.1	8.0	-14	2.2E	3.2
C5/C6	-0.1	7.5	-1	-0.5	7.5	-7	0.8E	0.8
C6/C7	-5.1	8.8	-58	2.2	8.8	58	4.9F	2.2
C7/T1	-1.4	8.8	-16	5.3	8.8	121	10.6F	5.3

OCC SI
C1 SI
C2 IS
C3 IS
C4 IS
C5
C6 SI
C7 SI

F 3 deg/div E
Patient Ideal

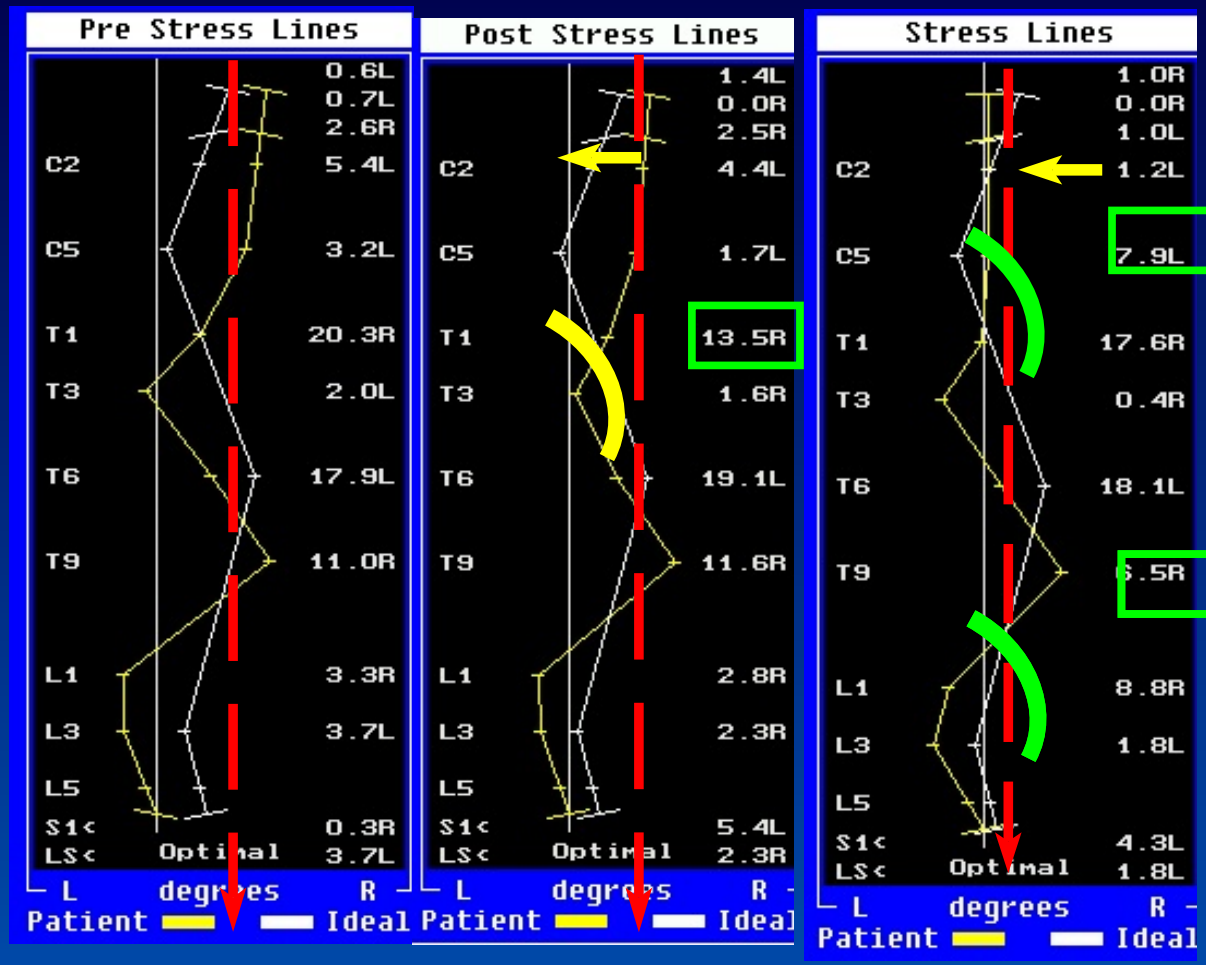
LATERAL STRESS LINES
x-rayed 03-12-09

LATERAL TREATMENT

OCC: C1: C2: C3: C4: C5: C6: C7:
Head Wt: Other:

C1 RDT	_____ deg	C2 SP	3.9R mm
CSV1<	22.2 deg	CSV2<	_____ deg
TSV<	_____ deg	GC5	6.9A mm
LSV<	-22.9 deg	SHLD HG	_____ mm

Biomechanical Summary and Treatment



Initial x-ray

Spinal system severely off balance to the right

20 Treatments

Spinal system translates left, decrease in T3 angle

40 Treatments

Spinal system translates left to balance by decreasing L1 angle and increasing T1 and C5 angle

Treatment Outcome

20 treatments pain went to 6/7, now using cane instead of walker

40 treatments, pain 2/3, walking without cane, doing most ADL

- Two years following initial treatment. Patient treats once every three months and maintaining pain level at 2/3 and performing most ADL