

Pilates as an effective form of exercise for Age Related  
problems including Adult Scoliosis:  
A Case Study

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## **Abstract**

Many patients with adult scoliosis do not have any specific symptoms as they vary based on the curve severity, however the curvature can progress with time, causing back pain, muscle fatigue due to imbalances and poor posture. In the older population these problems may also be exacerbated by degeneration of the spine and other age related issues. These difficulties can consequently hinder normal daily living as scoliosis cannot be cured, however the effects could be diminished by a suitable exercise programme.

The purpose of this case study is to see if a Pilates based exercise programme could improve the quality of life and ease the pain of a female client suffering from aches and pains due to age related problems including adult scoliosis. After a five month period of attending regular classes, my client said that she felt less pain, was able to achieve movements that previously she was incapable of and above all, her posture improved along with her confidence. The client has seen and felt the improvements that Pilates has made to her life, and is enthusiastic and eager to continue with future sessions.

## **Table of Contents**

Title Page

Abstract

Table of Contents

Anatomical Description

Case Study

Exercise Programme

Conclusion

Bibliography

## Anatomical Description

The spine is made up of 24 vertebrae which are responsible for the primary movements of the spine, and around 9 that are fused. The vertebrae are stacked one upon the next and arranged into 5 regions: cervical (7 ), thoracic (12 ), lumbar (5 ), sacral (5 fused ) and the coccyx (~ 4 fused ), which is also known as the tailbone. When the body is viewed from the side, each region has a distinct curve which, when balanced correctly, contributes to ideal alignment and plays an important role in both enhancing movements of the spine and shock absorption. When viewed from the back, the spine should run straight up and down in the middle of the back and symmetry should be observed, as shown in Figure 1. The spine can be extremely mobile allowing multidirectional movements of the trunk, and also very stable to support movement of the limbs.

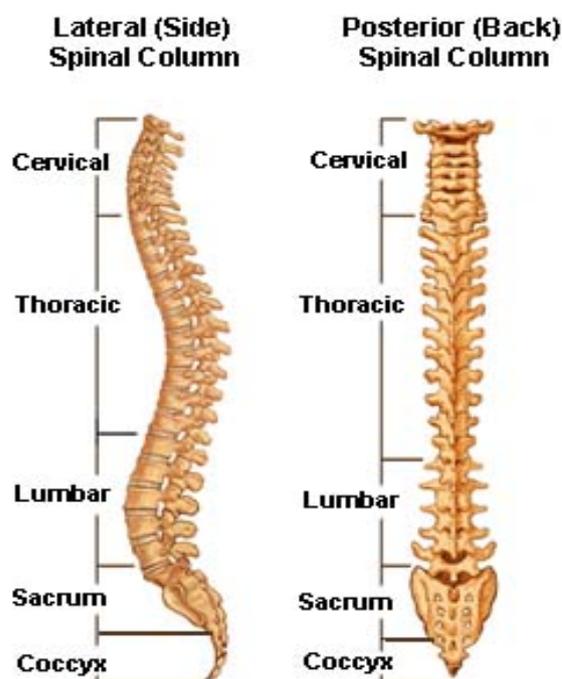


Figure 1. Regions and curves of a normal spine.

Scoliosis refers to an abnormal lateral curvature of the spine which involves a twisting or rotation of the vertebrae. The major or primary curvature can be C or S shaped, however to maintain an upright standing position, several compensatory curvatures can also develop, as shown in Figure 2.

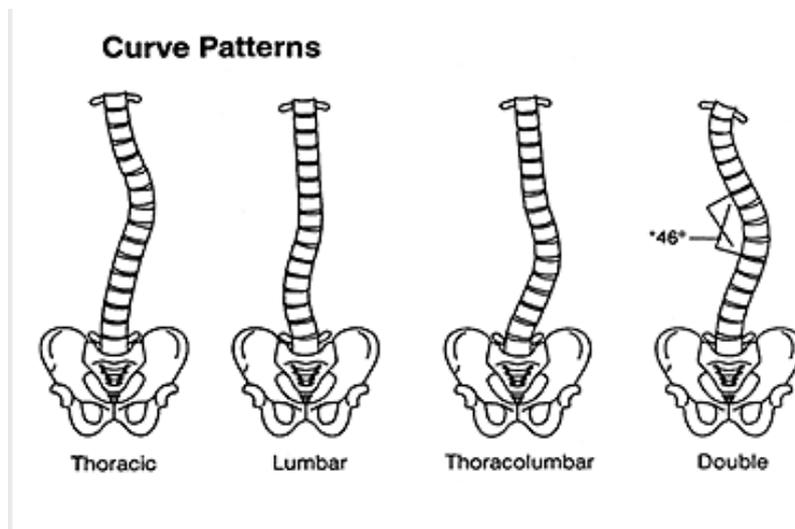


Figure 2. Types of Scoliosis curves

As the vertebrae rotate this leads to a change in the appearance of the patient's back.

Patients may notice asymmetry of the spine and torso, for example, one shoulder or shoulder blade is higher than the other, the ribcage appears higher on the convex side of the curvature, one hip may appear higher than the other, one leg may appear shorter than the other, the body may tilt to one side or the waist appears uneven. This is because the muscles on the concave side of the curvature are usually shorter and tighter than the muscles on the convex side, which are longer and weaker. Rotational effects can also give the appearance of excessive thoracic kyphosis or hyper lordosis of the lumbar or cervical spine.

There are two general categories of scoliosis: 'structural' or 'nonstructural' which scoliosis is less serious and can be caused by a variety of factors: leg length difference, injury, repeated unbalanced activity or postural, and is usually reversible.

Structural is the most common category of scoliosis, affects the spine's structure, is considered permanent and is divided into four types: idiopathic, neuromuscular, congenital and degenerative. The most common type of structural scoliosis is idiopathic scoliosis of which there is no known cause and often occurs during adolescence, however it may not be addressed until the curve becomes problematic later in adulthood. Degenerative scoliosis, also known as adult onset scoliosis usually occurs after the age of 50 and is caused by age related changes causing degeneration of the facet joints, intervertebral discs, osteoporosis or arthritis. Uneven degradation of these discs and joints can cause spinal curvature to become more pronounced on one side. It is estimated that at least 60% of the population over age 60 has at least mild degenerative scoliosis.

Although many forms of scoliosis are not painful, degenerative scoliosis certainly can be. The symptoms vary depending on the severity of the curve and may include back pain due to muscle imbalances, spinal stiffness and possibly nerve pain.

There is no proper cure for scoliosis, and treatment can involve observation, bracing (however this is not used in the UK), pain relieving medication, surgery as a last resort, physiotherapy, manipulation by chiropractors and for the majority of people, prescribed exercise. Pilates as an exercise approach has been proven to be useful in the management of scoliosis. It does not usually reverse scoliosis however it can help to improve posture awareness, core strength, flexibility, correct muscle imbalances and develop a more positive body image.

## Case Study

My client Shelagh is a 65 year old lady who, when asked to fill in my health questionnaire, said she had scoliosis of the lower spine, mild arthritis of the hips, and a historic undiagnosed problem with her left knee preventing her kneeling. In addition she said that at around the age of 14, she was tall which made her feel very self conscious and to counteract this, she used to slump or hip-hike when standing, so as not to appear so tall. Later she noticed that one hip was slightly higher than the other, but nothing was done about this.

About 10 years ago she noticed that her back hurt when she did housework or gardening and went to an osteopath who diagnosed that she had scoliosis, which was seen in her X-rays at L2-L4 of her lumbar spine. She has continued to go to the osteopath to help with the pain in her back and also her knee, however her current office duties as an office administrator has increased her back pain, along with neck and shoulder pain.

Shelagh's current physical activities are going walking with friends, walking her dog and gardening. She has previously done some yoga but found it very difficult to get down to the floor and up again and now wanted to take up Pilates to strengthen her knee and improve her spine problems. She did however not want to join a class because she felt she had too many problems and therefore would not be able to do any of the exercises satisfactorily.

When she was standing facing me, it was obvious that her waist and hips appeared uneven, and her right hip appeared to stick out more giving the appearance of a pronounced waist.

In addition her knees had a tendency to roll inwards (genu valgum), and her left foot pronated, and also externally rotated.

When viewed from the back, her right shoulder was slightly lower than her left, and her spine showed a left lumbar curvature with associated left muscle bulge. This was more obvious when I asked her to do a roll down.

Shelagh's scoliosis could be described as a left Lumbar curve with a dominant muscle block which would be strong, tight and overworked. In comparison, the right side of her spine appeared sunken due to relatively underused and weak muscles. Over time the curve would have become exaggerated as she was naturally right handed and carried her handbag over the right shoulder. When viewed from the side she also had a slight roundness to the shoulders along with a forward head projection.

As she had done very little exercise other than walking, I believe that my challenge was to teach her how to improve her posture, realign herself by lengthening her spine, strengthen her core muscles, develop the weaker side of her body, improve her balance and joint mobility, and then help her maintain this awareness.

When aiming towards good posture standing alignment is important. Ideal standing alignment when viewed from the side, is a position in which the head, torso and pelvis are aligned one above the other and above the feet. Improving her posture would help with the abnormalities in the lower back and would be achieved by strengthening the abdominal and back extensor muscles to support and lengthen the spine. Good posture would also include proper alignment of the head, neck and shoulders. This would counteract some of the neck and shoulder pain caused by the forward posture and increased kyphosis due to years of

working in an office. Increasing the strength of the upper spinal extensors would improve this condition. All of these effects could be achieved with a continuous Pilates exercise program.

## **Exercise Programme**

As Shelagh had never done any Pilates before, my first job was to introduce her to fundamental matwork incorporating the principals of Pilates: Awareness, Balance, Breath, Concentration, Centre, Control, Efficiency, Flow, Precision and Harmony. We started with some breathing exercises to help her become aware of the feelings within her body, focus on the hour ahead and connect into the abdominal muscles. For her to understand the movements involved, I used verbal, tactile and visual cueing, and also some imagery.

I explained about the 'core' or powerhouse, finding neutral pelvis and neutral spine, and standing alignment. Roll downs were used as an assessment tool for assessing posture and alignment, and matwork preparation exercises were performed on the Cadillac bed (as she could not easily get down to the floor) . In semi supine position during matwork, special effort was made to check the alignment of her body on the mat, her awareness of neutral spine and neutral pelvis positions, lengthening the neck, and activating the core muscles. Shelagh originally found it difficult to coordinate the breathing with the exercises, however once this was mastered, further matwork and subsequently equipment exercises were gradually added to the programme

The exercises used are tabulated below along with objectives, muscle focus and comments on the exercise along with modifications. Work on the Equipment followed the BASI Block System alternating between four pieces of equipment: Reformer, Cadillac, Wanda Chair and Pilates Arc.

<i>Exercise</i>	<i>Objective and Muscle focus</i>	<i>Comments</i>
<b>Roll Down</b>	Uses abdominals and back extensors to develop articulation of spine, stretch the back and the hamstrings	The exercise was also performed against a wall for feedback. During the return of the roll down against the wall I noticed that the left side of her torso met the wall first. To be able to keep her feet hip distance apart and parallel, her knees would turn in, so I would prompt her to feel the thighs wrapping outwards to counteract this
Neutral spine taking arms back behind head	Breath awareness and position of spine on the mat	Inhaling to take arms back and exhaling to bring them forward Trying not to flare the ribs while the arms move
Pelvic tilt <b>Pelvic curl</b>	Awareness of inner core Spinal articulation, Hamstring control. Uses abdominals and hamstrings	Drawing in abdominals on exhale. Overall between knees to keep legs in alignment, engaging inner thighs. Peeling up with control and feeling all parts of the spine returning evenly and in sequence to mat on the return
Pelvic curl then taking arms back	More awareness of the spine returning to the mat sequentially	Feeling the stretch of the lower spine
Knees side to side	Spinal rotation, Pelvic lumbar stabilization, using abdominals, with oblique emphasis.	Squeezing thin foam block to keep knees together. Using obliques to rotate the pelvis when legs to go to the side and deep drawing in abdominals bringing the knees back. Keeping upper body stable.
<b>Chest lift</b>	Abdominal strength, pelvic stabilization	Keeping tailbone down while drawing in abdominals to keep pelvis in neutral. Keeping the weight of the head in the hands to prevent neck tension
<b>Chest lift with rotation</b>	Abdominal strength, pelvic stability during spinal rotation	Shortening the space between lower ribs and opposite hip to create the rotation rather than using the elbows.
<b>Leg lifts/ Leg changes</b>	Pelvic stabilization, Hip disassociation	Coordinating breath with the movement. Keeping pelvis stable and weight equally distributed. Isolating the movement at the hip joint

<b>Back extension</b>	Flexing and extending the spine using a posterior and anterior pelvic movement, using abdominals and spinal extensors	At this stage she could not lie prone as it hurt her knees so the objective was met by her standing with flexed knees and hands on thighs, or sitting.
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As she progressed with these exercises with improved strength and control, further mat exercises were added

<i>Exercise</i>	<i>Objective and Muscle focus</i>	<i>Comments</i>
Sitting curl backs , to prepare for Roll Up	Articulation of lumbar spine, using the abdominals	Holding backs of thighs, exhaling to C-curve back, inhaling to sit up tall. Going a little further each time.
<b>Spine twist supine</b>	Spinal rotation, Pelvic lumbar stabilization	Keeping upper body stable as pelvis rotates
<b>Hundred prep</b>	Abdominal strength, trunk and pelvic stabilization	Semi supine position, with feet on mat, used to develop stamina
Side lying , <b>Side lifts</b>	Trunk stabilisation and strengthening lateral flexors	Legs in slightly forward position to take pressure of lower spine. Focussing on breathing and drawing abdominals in on exhale. She found this very difficult to do while lying on her right side, but slightly easier on her left side.
<b>Side Leg lift, Forward with lift, Forward with drops</b>	<b>Gluteal Side Lying Series:</b> Pelvic lumbar stabilization, hip abductor strength, strengthening Gluteus medius	Maintain neutral spine, keeping forward foot relaxed. As the lower leg is bent at 90 degrees, these movements were easier to achieve.
<b>Spine stretch</b>	Spinal articulation, trunk stabilization and hamstring stretch. Using spinal extensors and flexors	Sitting tall slightly bent legs. Flexing the lower spine to achieve a C-curve in the lower back
<b>Spine twist</b>	Trunk mobility, back extensor control, Abdominal obliques	Sitting tall, legs together, abdominals drawn in drawn in, breast bone forward, legs slightly bent, thinking of length when rotating
Side stretch, hands behind head	Oblique stretch using Abdominals and obliques	Focus on keeping trunk stable and keeping weight equal on each side of the pelvis, inhaling into stretched side.
<b>Back extension</b>	To strengthen the back, and spinal extensors. Hands under forehead , and with a cushion under the ankles.	Keeping tummy drawn in, bringing breast bone forward and widening the collar bones, feeling the work in the thoracic spine. The cushion relieves the pressure on the knees.
<b>Rest position</b>	Relaxation of back and shoulders, stretch lower	She cannot kneel and so this could not be achieved

	spine	
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**Footwork** was done on the Reformer and on the Cadillac but facing towards the PT bar tower for better pelvic stabilization. Only double leg and calf raises were performed on the Wanda Chair focussing on keeping a nice upright posture.

<i>Equipment</i>	<i>Exercise</i>	<i>Objective and Muscle focus</i>	<i>Comments</i>
<b>Reformer, Cadillac and Wanda Chair</b>	<b>Parallel Heels / Toes, V-Position Toes, Open V-Heels / Toes, Calf Raises</b>	Trunk stability, strengthening of hip and knee extensors. Hamstrings, Quads	Keeping the pelvis stable, and the alignment of the legs in parallel using an Overall between the knees on the Reformer. Controlling the return movement by resisting the springs.
		Ankle plantar flexor strength	Focussing on wrapping the thighs outwards to keep knees parallel, but weight into big toes to prevent ankles from supinating.
<b>Reformer and Cadillac</b>	<b>Prances</b>		
<b>Reformer</b>	<b>Prehensile</b>	Strengthening the arch of the foot	
<b>Reformer and Cadillac</b>	<b>Single Leg Heel/ Toes</b>	Looking for imbalances. Hamstrings, Quads	Keeping equal weight at the back of the pelvis

### **Abdominal work**

<b>Reformer</b>	<b>Hundred prep</b>	Abdominal strength, pelvic lumbar stabilization	Keeping pelvis neutral
	<b>Co-ordination</b>		
<b>Cadillac</b>	<b>Roll Up RU Bar</b>	To strengthen the abdominal muscles, stretch the back muscles	Focussing on deep C-curve when articulating up and down
	<b>Breathing with PT bar</b>	Improve spinal articulation, co-ordination and breathing	Focussing on the three distinct movements of this exercise, she only progressed to keeping her feet on the bed.
<b>Pilates Arc</b>	<b>Chest lift</b>	Abdominal strength and thoracic stretch. A valuable back	A cushion and yoga mat was placed over the peak of the Arc to make the surface more comfortable. Focussing on

		extension is achieved with this exercise	keeping the back of the ribcage drawn into the Arc.
<b>Wanda Chair</b>	<b>Standing pike</b>	To increase lumbar flexibility, improve scapular control	Drawing abdominals upwards and preventing pelvis from moving backwards
	<b>Standing pike reverse</b>	Abdominal and back extensor control and scapular stabilization	Breastbone forwards to extend the back, and keeping thighs vertical.

### Hipwork

<b>Reformer and Cadillac</b>	<b>Frog</b>	Hip and knee strength and control. Hip adductors	Keeping pelvis down and squeezing heels to engage inner thighs. She held the Cadillac uprights to stabilise her upper body.
	<b>Circles Up, Down</b>	Pelvic lumbar stabilization, Hip adductors extensors, hamstrings	Making sure back doesn't arch and pelvis doesn't tuck to achieve hip disassociation Focussing on keeping neutral pelvis
<b>Reformer</b>	<b>Openings</b>	To improve range of movement at the hip joint.	Focussing on keeping neutral pelvis
<b>Cadillac</b>	<b>Walking Bicycles and bicycles reverse</b>	Hip extensor control, hip disassociation, pelvic lumbar stabilization	Keeping weight equal on each side of the pelvis.

Spinal articulation specific exercises were not attempted at this time.

Stretches. As she could not kneel, the standing or kneeling lunges could not be done, and so alternatives were used.

<i>Equipment</i>	<i>Exercise</i>	<i>Objective and Muscle focus</i>	<i>Comments</i>
<b>Matwork Swiss Ball Pole series using a flexi band</b>	<b>Shoulder stretch</b>	Shoulder stretch and scapular stabilization. Lower trapezius	Maintaining trunk stabilization and keeping head aligned with spine
	<b>Overhead stretch</b>	Chest and shoulder stretch. Pectorals	Avoiding flaring the ribs as arms are taken back
	<b>Side stretch</b>	Oblique stretch Abdominals and obliques	Focus on keeping trunk stable and preventing opposite hip moving outwards
	<b>Spine twist</b>	Trunk and oblique control	Maintain equal weight on both feet
<b>Pilates Arc</b>	<b>Shoulder</b>	Shoulder and	Using Pilates Arc, with a cushion to

	<b>stretch lying side</b>	thoracic stretch. Latissimus dorsi and pectorals	support the head. It was quite difficult for her to achieve the correct position, but she appreciated the stretch
<b>Matwork</b>	Supine leg stretches using a flexiband	Outer and Inner thigh stretches. Hamstrings, Abductors and Adductors	Focussing on hip dissociation, and keeping the pelvis down.

### Full Body Integration

<b>Cadillac</b>	<b>Sitting Forward</b>	Abdominals, hamstring stretch and spinal mobility	Differentiating between flexing and extending the spine with shoulders stable.
	<b>Side Reach</b>	Abdominal control, oblique and shoulder adductor stretch	Maintaining c-curve and equal weight on both sitting bones and feeling the diagonal stretch across the body.

### Armwork

<b>Reformer</b>	<b>Extension, Adduction, Circles Up, Down, Triceps</b>	Scapular stabilization and shoulder mobility. Latissimus dorsi, triceps	<b>Arms supine series:</b> Keeping trunk and legs stable as the arms move, and stretching the arms with a good range of movement.
<b>Reformer</b>	<b>Chest Expansion, Biceps, Rhomboids, Hug-a-tree, Salute</b>	Trunk stabilization, Latissimus dorsi, biceps, posterior deltoid, pectorals, triceps	<b>Arms sitting series :</b> The main focus of this was to maintain a good upright posture while moving the arms, however as it was uncomfortable for her to sit correctly, the long box was placed on the reformer for her to sit on.
<b>Cadillac</b>	<b>Shoulder adduction double arm</b>	Shoulder adductor control using Latissimus dorsi, and serratus anterior	Focussing on the work in the back by keeping elbows and collar bones wide
	<b>Shoulder adduction single arm</b>		Elbow slightly forward of arm to maintain external rotation of shoulder
<b>Wanda Chair</b>	<b>Shrugs</b>	Trunk stabilization, Mid and lower trapezius	Keeping back straight , scapular stable and avoiding leaning back
	<b>Triceps Press sit</b>	Trunk stabilization, elbow extensor strength, triceps	

### Legwork

<b>Wanda Chair</b>	<b>Leg Press standing</b>	To improve balance and strengthen hip	Keeping back straight , but holding a pole to aid with balance. Focussing on
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		and knee extensors using hamstrings	pulling the bar back.
<b>Wanda Chair</b>	<b>Hamstring Curl</b>	Pelvic lumbar stabilization, hamstrings	Maintaining neutral pelvis
<b>Cadillac</b>	<b>Squats</b>	Quadriceps, Biceps	Standing, weight distributed between both feet, knees over ankles, pushing sitting bones back and arms up on exhale, inhale to stand upright

**Lateral flexion / Rotation:**

<b>Reformer</b>	<b>Mermaid</b>	Spinal mobility, scapular stabilization using abs, deltoids and latissimus dorsi	As Shelagh could not bend her knees sufficiently , even with sitting sideways on the reformer, this was not successful
<b>Wanda Chair</b>	<b>Side stretch</b>	Lateral flexor stretch, Abdominals with oblique emphasis	Lifting out of the underneath side of the waist, breathing into the opposite ribs and trying to avoid rotating. She enjoyed this stretch in the side of the body.
<b>Pilates Arc</b>	<b>Side lift</b>		Straight Leg lengthened away, looking forward and trying to avoid rotation. However this exercise was quite painful while lifting the trunk.

**Back Extension** was achieved using Standing or Matwork versions, as any prone work on the equipment she found to be too painful.

After several months of working with Shelagh, I went on a Scoliosis specific, Pilates course and was then able to target modified exercises more specifically for her. I added several elongating stretches into the sequence of exercises: either holding the Cadillac top bar and bending the legs to achieve a closed chain elongation of the spine, or holding the Cadillac uprights and flexing forward into a flat back with straight arms, and pushing sitting bones away. I also asked her to do her pelvic curls over the Roll Up Bar on the Cadillac to provide traction. She appreciated all of these.

For all her matwork and supine equipment work I placed a foam pad under the left side of her lower back and told her to breathe and sink into the right side of her back, to create a more balanced muscle action. Side lying on the left was achieved with the foam pad under her left lower waist, to lift the convex curve in the spine and create a more neutral spine, whereas side lying on the right was achieved by using two foam pads, one under her hip and one under the shoulder blade to sink the spine into its neutral position. She then found the exercises slightly easier to do.

## **Conclusion**

Pilates is a system of physical and mental conditioning helping mind and body to work in harmony. The benefits include improved core strength, flexibility, joint mobility, posture awareness and balance, and then with its focus on alignment, Pilates aims to produce symmetry in the body.

After a five month period of coming fairly regularly, and working through the BASI Block system, Shelagh said that she had less pain and for that reason didn't feel the need go to the osteopath as often as she had done in the past. I could see that she was able to achieve movements that she originally could not do, therefore had developed more strength and flexibility. She said that she was more aware of her core, her posture had improved and she had also lost weight, resulting in greater self confidence.

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