

# **AXIAL MOBILITY EXERCISE PROGRAM**

**AN EXERCISE PROGRAM TO IMPROVE FUNCTIONAL ABILITY**

## **THERAPIST'S MANUAL**

Margaret Schenkman Ph.D., PT  
Julie Keysor PT  
Julie Chandler M.S., PT  
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Helga MacAller PT

Claude D. Pepper Older American's Independence Center at  
Duke University

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Second Edition

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## THE CLAUDE D. PEPPER OLDER AMERICANS INDEPENDENCE CENTER

The Claude D. Pepper Older Americans Independence Center (OAIC) was funded by the National Institute of Aging in October, 1992. This Center is designed to investigate interventions that assist older Americans to retain their independence under a variety of situations. The Center includes four clinical research trials of physical interventions. These intervention studies are based on the concept that improvements of axial mobility (mobility of the neck and back) should lead to improved ability to carry out daily functional activities. One of the intervention studies is designed for sedentary older persons and will compare an aerobic conditioning program with an aerobic plus axial mobility exercise program. The second study investigates the benefit of axial mobility exercises for individuals who are in early stages of Parkinson's disease. The third study investigates the efficacy of exercise for women with osteoporosis who live in life care communities. And the fourth study investigates an exercise prescription based program for nursing home residents.

The exercises outlined in this manual were developed for use in the first two studies: Exercises for seden-

tary older individuals and for people in early stages of Parkinson's disease. The programs are being used as the exercise protocol for these two randomized clinical trials. Data from the Parkinson's disease intervention study will be analyzed in 1995. Data from the sedentary older individual study will be analyzed in 1997.

A manual for participants is available that presents the exercises in a format designed for home use. The exercises are the same in both manuals, with several of the titles of the exercises changed in the participant's manual to facilitate comprehension. The goal of the program is for the patient to continue the exercises at home after learning the program under the direction of a physical therapist. The manuals are available for purchase together for a cost of \$12.00. Requests should be sent to Claire McDonnell, DUMC Box 3600, Durham, NC 27710, with checks made payable to Duke University Medical Center. Any questions about purchasing manuals can be answered by calling (919) 660-7510 out of state, or toll-free in North Carolina at 1(800) 672-4213.

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## AXIAL MOBILITY AND PHYSICAL PERFORMANCE

A major focus in physical therapy treatment is to improve physical performance. Physical performance and functional ability are influenced by a myriad of physical and non-physical factors; ranging from strength, flexibility and sensation, to cognition, motivation, social support and the home environment. Many physical impairments, such as loss of range of motion and strength, have been correlated with declining functional mobility and can be improved through appropriate exercise<sup>1,2</sup>. Furthermore, Duncan et. al. reported that the decline in physical function commonly found in the elderly is better explained by an accumulation of physiological deficits than by any one specific impairment<sup>1</sup>. Functional gain may be achieved in impaired individuals if the cumulative burden of deficits can be lessened. The role of the physical therapist is to recognize modifiable factors and to direct treatment appropriately.

One potentially modifiable factor which can influence physical performance and function is spinal range of motion. Prescott et. al. found an association between spinal flexibility and physical performance measures<sup>3</sup>. The role of the spine in functional performance can be appreciated by analyzing common tasks. For example, moving from supine to sitting may be easily accomplished by rolling to the side while simultaneously pushing up with the upper extremities. This movement requires cervical and thoracic rotation to roll, and lateral flexion to bring the trunk upright. A person with a stiff spine, however, may instead sit straight up by using the abdominal muscles to raise the trunk, and then move the lower extremities off the bed by scooting and turning the entire body. This maneuver can be very energy consuming.

The sit to stand transfer is another example of a movement which is more efficient with adequate spinal motion. A person who lacks the ability to extend the lumbar spine and anteriorly tilt the pelvis may flex the trunk excessively in order to move the center of gravity over the feet while coming to standing. Another strategy would be to generate momentum by rocking the trunk forward. A final example is the ability to turn and see behind oneself, which is most effectively accomplished with rotation of the entire spine relative to the pelvis. In standing, a person who lacks adequate spinal rotation will most likely have to take multiple steps, turning the lower extremities, pelvis and spine together in order to look behind her/himself. Because the pelvis and lower extremities are more fixed in sitting, the ability to look posteriorly can be severely limited without spinal rota-

tion. Older people often report difficulty with driving because they can not turn to look behind themselves.

The axial structures form the supportive base from which movement of the limbs and head occur. The mobility as well as the configuration of the spine can, therefore, affect the ability to move adjacent joints of the shoulder and pelvic complexes. For example, overhead activities requiring shoulder flexion can be limited in persons with severe kyphosis because scapular motion is restricted by faulty thoracic alignment. Without adequate scapular motion, shoulder flexion range of motion will be compromised. At the pelvic complex, a patient who lacks lumbo-pelvic movement may not demonstrate the lateral tilt or anterior pelvic tilt associated with normal gait. This can be observed as a lack of lateral weight shift and functional hip extension, respectively.

Loss of axial mobility can be a consequence of specific diseases, such as Parkinson's disease, as well as aging itself<sup>4</sup>. Many authors have described reductions in spinal flexion, extension and lateral flexion of up to 50% in subjects from the third to eighth decades<sup>5-10</sup>.

Few exercises programs systematically address the motion of the axial structures and incorporate it into daily activities. The Axial Mobility Exercise Program presented in this manual provides a comprehensive set of exercises that address motion in all planes and for all regions of the spine, shoulder and pelvic complexes. From a kinesiological perspective, emphasis is placed on the mobility of these regions in a functional context. Both segmental and coordinated movements are practiced, and special consideration is given to proper positioning, alignment and range of motion. From a motor control perspective, movement patterns are improved. Relaxation is used to reduce excessive effort; awareness of body position and of the muscles and segments that are utilized in movement is used to enhance efficiency and coordination. The exercises presented have been expanded from previous work<sup>4,11</sup> to include functional exercises which incorporate new movement patterns into daily activities.

A participant's manual is available that presents the exercises in a format designed for home use<sup>12</sup>. The exercises are the same in both manuals, with several of the names changed in the participant's manual to facilitate comprehension. The goal of the program is for the patient to continue the exercises at home after learning the program under the direction of a physical therapist.

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## INTRODUCTION TO THE EXERCISE PROGRAM

This exercise program is designed to improve mobility, function, and postural alignment. It is intended to increase axial and extremity range of motion through the relaxation of synergistic muscles and lengthening of soft tissue structures. As this occurs, postural alignment improves and the ability to use muscle groups with appropriate mechanical advantage is enhanced. This increased capacity allows decreased effort and increased efficiency of movement, so that optimal movement patterns can be achieved. A main objective is to integrate isolated and coordinated movement into daily activities.

### The Exercises are based on several principles:

1. These exercises are not designed to increase strength or mobility beyond normal levels, but to enhance participation of appropriate synergistic muscles. Participation of muscles that are overactive should be decreased, and participation of muscles that are not active enough should be increased.
2. Individuals can increase range of motion and ability to coordinate movement through exercises that emphasize relaxation as opposed to effort.

The participant should be as relaxed as possible prior to initiating these exercises. Gentle diaphragmatic breathing promotes relaxation of musculature throughout the body in order to achieve optimal relaxation prior to initiating exercises.

Muscle groups can be relaxed through deep breathing at that point in the range of motion when they first become tight. Deep breathing can be used at this point to increase range of motion through relaxation.

3. The axial structures form the base from which extremity and whole body motions occur.

The exercises are organized in such a way that relaxation and mobility of axial segments always proceeds mobility of limb segments. This proximal to distal progression is designed to ensure the optimum participation of all body segments during functional movement.

4. Isolated efficient movement of the axial skeleton can best be learned in supported positions so that the participant can focus attention on a minimum number of body segments.

5. The exercises become increasingly complex as the participant becomes proficient.

Complexity is achieved by increasing the number of segments that are moved coordinately (e.g. upper extremities and lower extremities together in supine; alternating between symmetrical and asymmetrical movement patterns).

Complexity is also achieved by decreasing the support structures (e.g. progressing from supine to sitting to standing). As the support surface is decreased, there are increased demands for balance control and it is necessary for more body segments to participate in the desired movement.

6. Each stage of the exercise program builds on previous stages. The participant should always begin the program with the early stage exercises in order to enhance relaxation and to retain optimal range of motion. As the participant progresses through the stages, s/he may use the more complex coordinated exercises from previous stages rather than repeating all of the exercises in each previous stage. The instructor may emphasize specific exercises according to the participant's individual needs.

7. The goal is for the participant to become independent in these exercises.

The program should be simple so that the participants will be able to follow the exercises and remain compliant.

The instructor should use a variety of handling techniques as needed to guide the desired movements and facilitate the participant's ability to learn the correct movement patterns. As the participant learns the appropriate execution of the exercises, the instructor should diminish the use of handling techniques and verbal cues until the participant is entirely independent.

### Functional mobility training and the home program are integral components of the exercise program.

These activities are designed to complement each exercise stage by:

1. Assisting the participant to become independent in the execution of the program
2. Assisting the participant to incorporate isolated coordinated movement into relevant functional activities of daily life.



To achieve the goals of this exercise program, the therapist and participant should observe several principles:

1. The exercises are to be performed slowly, in a relaxed and precise manner.

*The participant should be conscious of achieving the desired movements with minimal effort.*

The effort used should be just enough to perform the movement so that substitution by accessory muscles is minimized. Initially, neither the number of repetitions nor completion of a movement is important.

*Breathing is used to enhance relaxation*

Breathing can be used to enhance total body relaxation prior to initiating exercise. Breathing also can be used at the end of the range of available motion to promote relaxation of specific muscle groups and to increase range of specific body segments.

*Positioning is essential to optimum relaxation.*

Throughout the program, the participant must be optimally positioned with pillows or bolsters to provide support and to encourage relaxation. The instructor will modify the positioning as needed. In all cases the goal is to achieve as close to neutral alignment as possible.

Neutral alignment: In standing, ideal plumb line alignment runs through the external auditory meatus, the glenohumeral joint, posterior to the greater trochanter, anterior to the center of the knee joint, and anterior to the lateral malleolus. Alignment in supine is similar. In sitting, the upper body is aligned as described above, and the lower body is positioned with the feet flat on the supporting surface, with 90 degree angles at the hips, knees, and ankles. In prone, the spine should be as close to the described position for standing, using pillows and towel rolls as needed. The shoulders are positioned in abduction with the elbows flexed.

*Segments that are not participating in the desired motion must remain relaxed.*

For example, the shoulder complex should stay relaxed during sitting exercises to increase thoracic and lumbar rotation.

2. The instructor modifies the exercises as needed based on the participant's orthopedic, muscular, or medical impairments.

These exercises can be used appropriately with almost all people. Precautions and appropriate modifications should always be considered when working with participants who have diagnoses and conditions including but

not limited to:

- osteoarthritis
- osteoporosis
- spinal fusions
- history of low back pain
- other painful conditions of the spine and extremities
- severe cardiovascular disease

Modifications include but are not limited to the following:

- limit movement to a painfree range of motion
- modify positions to minimize pain (e.g. use pillows for comfortable positioning)
- avoid positions and movements that could cause fracture in an osteoporotic participant (e.g. consult with attending physician as necessary)
- monitor cardiovascular status in positions and during activities that could unduly stress the cardiovascular system (e.g. quadruped, prone, sit to stand).
- delete exercises if they are inappropriate (e.g. quadruped for individuals who have severe thoracic kyphosis).

3. The instructor modifies the progression of the exercises as needed. If a participant does not make gains in a particular stage, it may be necessary to move to the next stage while continuing to work on the earlier stage. The instructor should not feel that the participant must completely master all aspects of a particular stage before advancing.

4. Each participant should perform the exercises specified by the instructor daily in an individual *home exercise program*. The beginning of each session should consist of fundamental exercises from Stages I, II, and III to promote relaxation and preparation for more advanced exercises. The majority of time spent should be on the exercises of each specific stage and on specific impairments of the participant. All of the exercises, including functional mobility, should carry-over and be incorporated into daily functional activity and mobility.



## STAGE I: RELAXATION WHILE INCREASING RANGE OF MOTION IN SUPINE (WEEK 1)

The participant learns to relax and to isolate movement through small ranges of motion. As the participant learns to relax musculature, s/he begins to increase range of motion for each exercise. Isolation of movement is important, rather than the amount or range of motion.

### A. GOALS:

- Relax the trunk, hip, shoulder, and neck regions
- Increase range of motion while retaining relaxation
- Retain the relaxation of antagonist and accessory muscles while moving

### B. POSITION:

The participant lies supine for all of the following exercises. Pillows, towel rolls, and bolsters may be placed under the head, neck, and knees as needed, so that maximal relaxation and optimal alignment can be achieved within the available range of motion.

### C. SPECIFIC EXERCISES:

The participant should be able to perform these exer-

cises independently while remaining relaxed. Deep breathing during and at the end of a motion should be incorporated during this and all other stages. The external support by pillows and towel rolls may decrease as the participant's posture and alignment improves.

Deep breathing

Trunk

Hip

Shoulder

Neck

Coordinated neck, shoulder, hip or trunk motion

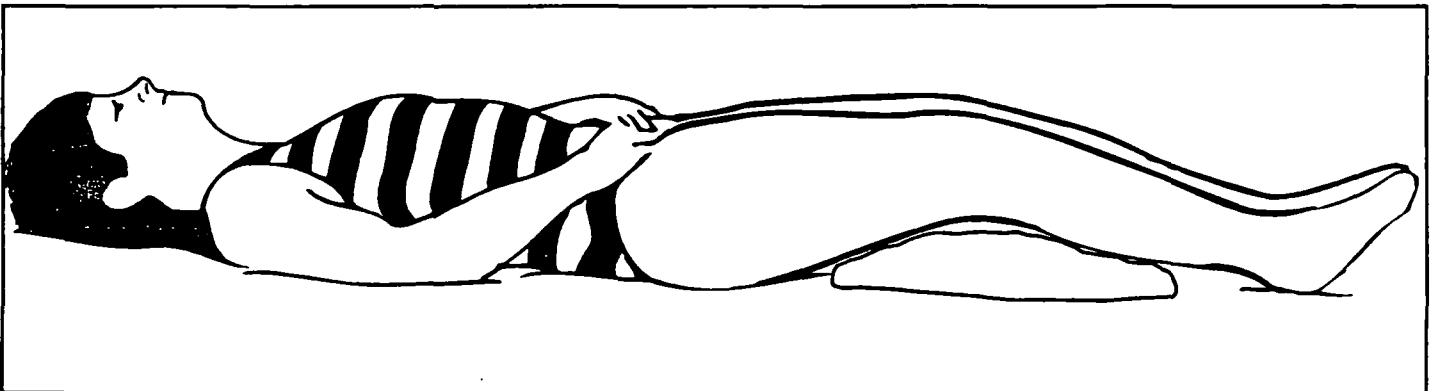
### D. CRITERIA FOR PROGRESSION

- The participant will demonstrate the ability to relax the trunk and neck
- The participant will isolate hip abduction and adduction, shoulder internal and external rotation, and cervical rotation without excessive participation of the antagonist/agonist musculature or movement of adjacent structures
- The participant will demonstrate increased range of motion in at least three of four body segments

### DEEP BREATHING:

**PURPOSE:** *Learn the use of breathing to promote relaxation*

Participant takes slow, full, diaphragmatic breaths in a relaxed manner with minimal effort. The participant should feel a reduction in total body tension.

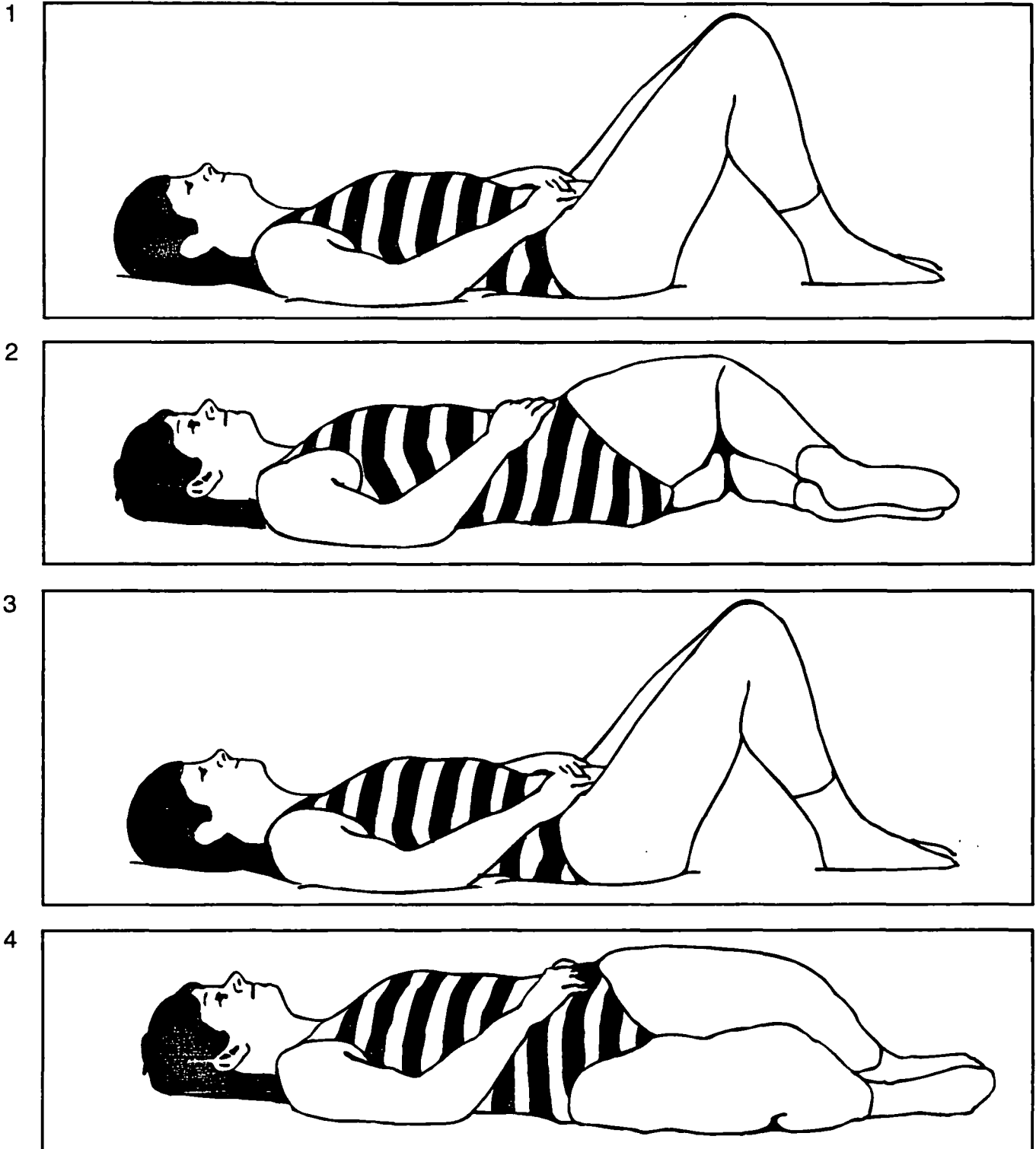


**TRUNK:**

**PURPOSE:** *Relax axial musculature for optimal elongation*

Participant flexes hips and knees (hook lying position) and moves knees side to side together to

achieve lower trunk rotation and elongation. The motion should be gentle to achieve relaxation of the axial structures, and the instructor should be able to feel a reduction in the participant's total body tension. The low back should not lift from the mat more than a few inches.



**HIP:**

**PURPOSE:** To relax the hip ab/adductor and rotator musculature for optimal elongation and appreciation of isolated movement

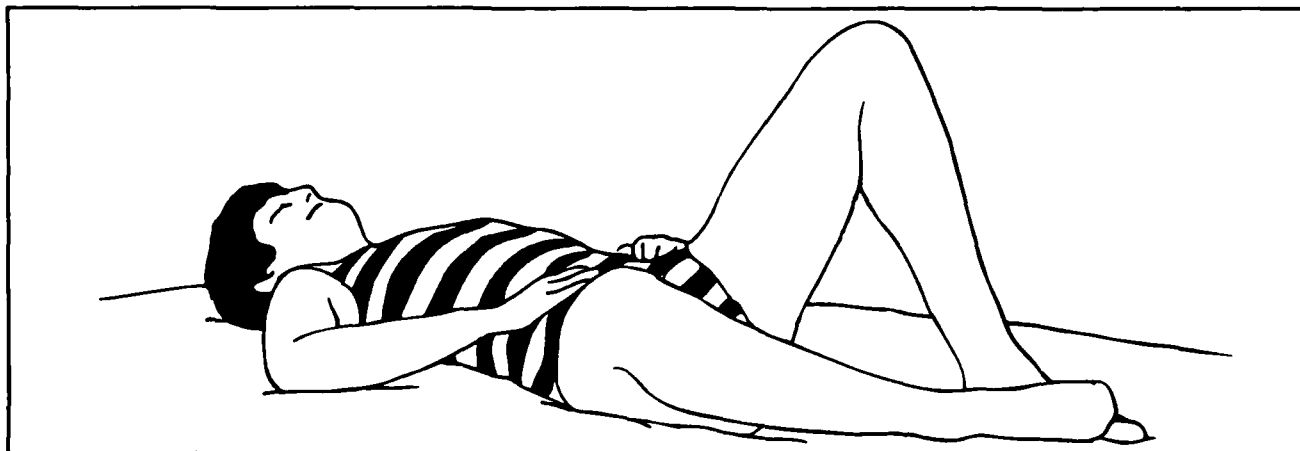
Participant flexes hips and knees (hook lying position) and moves knees from side to side to achieve hip ab/adduction without pelvic motion.

Movement may be performed either unilaterally or bilaterally. The pelvis/lower back should remain flat on the supporting surface as the hips move. In order to increase the stretch to the hip adductors, the participant can continue the rocking motion of each knee with the limb in positions of increasing hip abduction and knee extension.

1



2



3



**SHOULDER:**

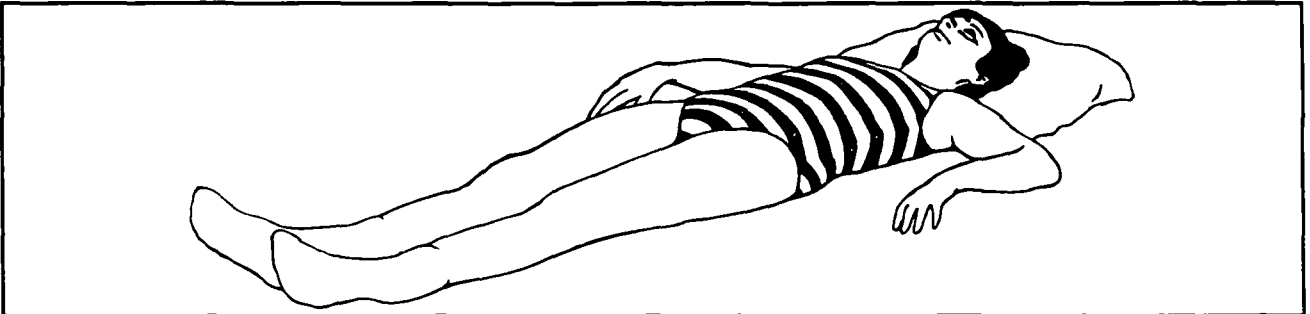
**PURPOSE:** *To relax the shoulder complex and upper trunk musculature for isolated internal/external glenohumeral motion*

Participant abducts one arm to about 90 degrees (or as close to 90 as possible) with elbow flexed. Motion is internal and external rotation of the shoulder, with minimal participation of scapular and pectoral muscles. Motion

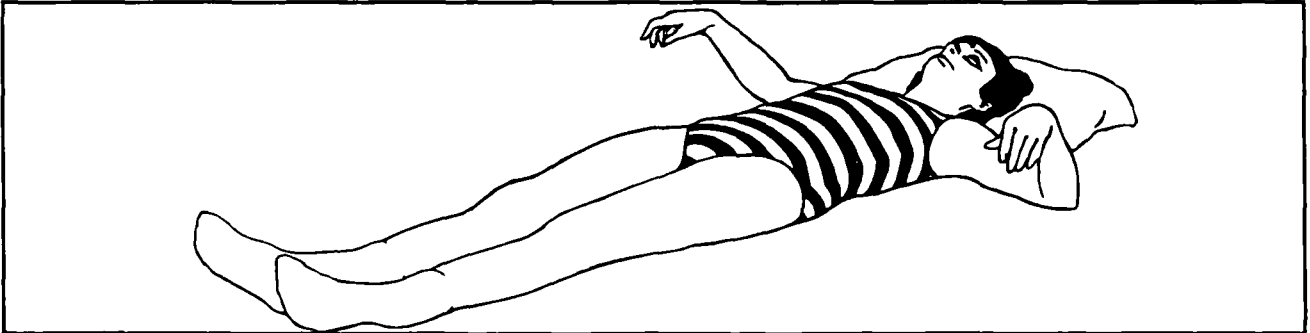
should be isolated to the glenohumeral joint with no scapular or trunk movement. The pectoralis muscles should be relaxed with the scapula in neutral alignment, so that the shoulder is as flat on the supporting surface as possible. This is a good position to increase chest expansion during the deep breathing exercises.

As the participant develops the ability to increase movement while retaining relaxation, s/he may begin to move both upper extremities simultaneously (same direction and then opposite directions).

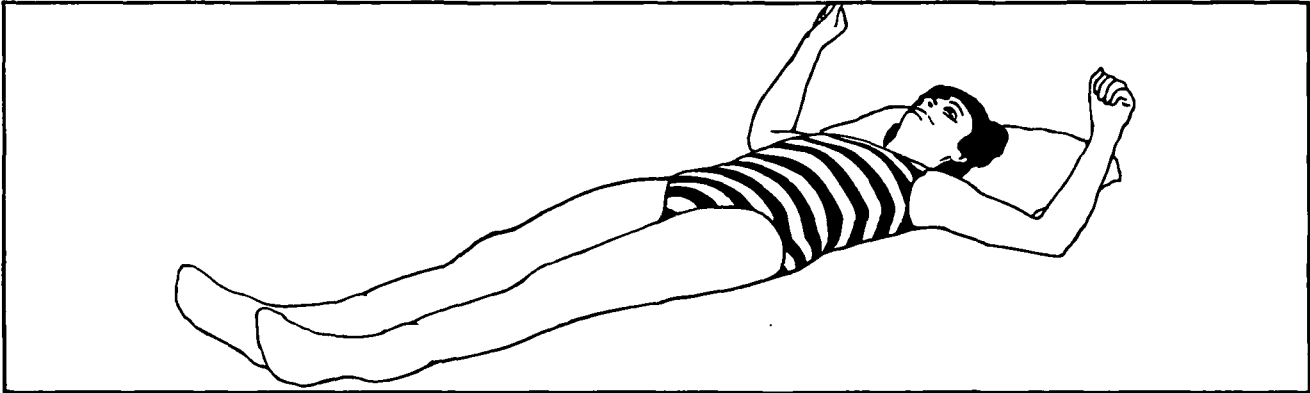
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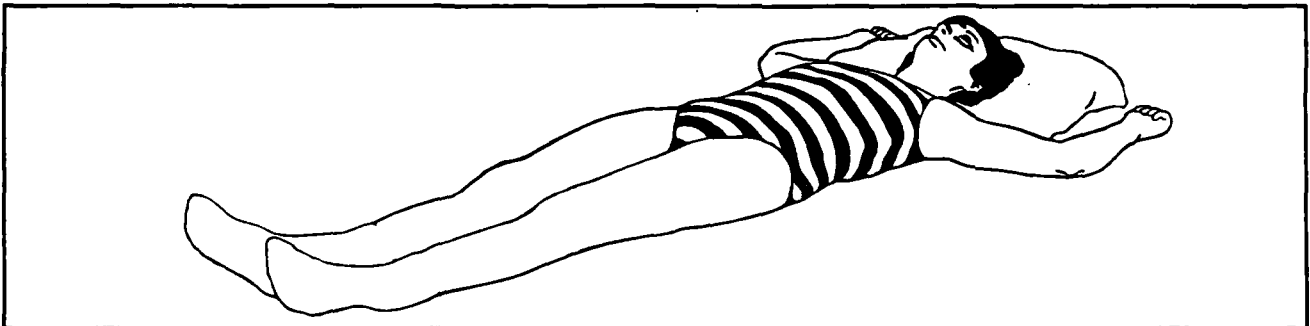
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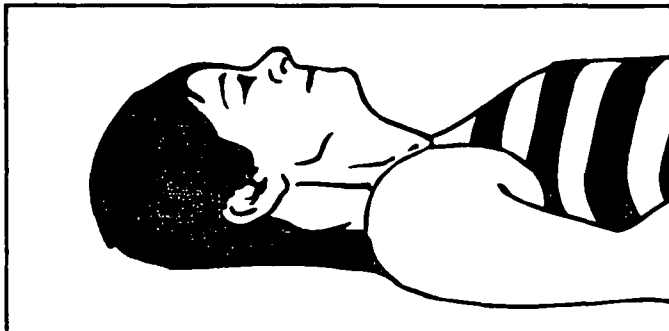


# NECK:

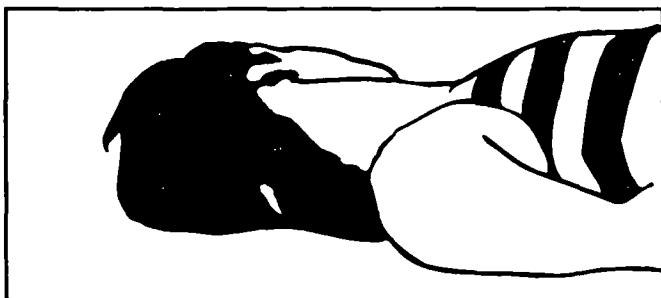
**PURPOSE:** To relax cervical musculature to improve range of motion and head position

The participant works on achieving proper resting head position by relaxation and awareness of the position of the head and shoulder complex. A towel roll or pillow(s) may be used to improve alignment and relaxation. The participant practices gentle rotation of the cervical spine, while maintaining good alignment. It is particularly important to work on relaxation of the sternocleidomastoid muscles.

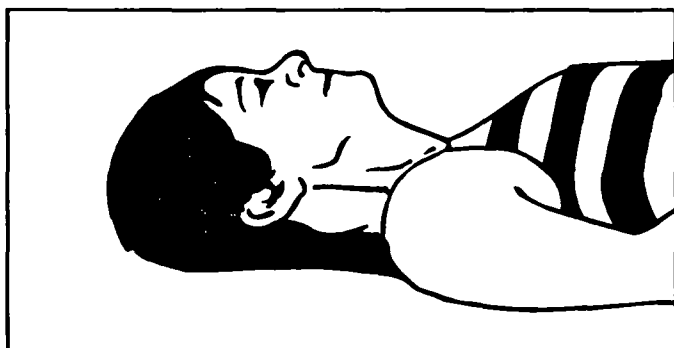
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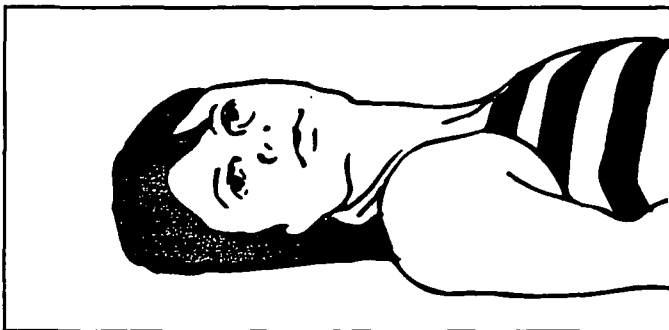
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**COORDINATED NECK, SHOULDER, HIP OR TRUNK MOTION:**

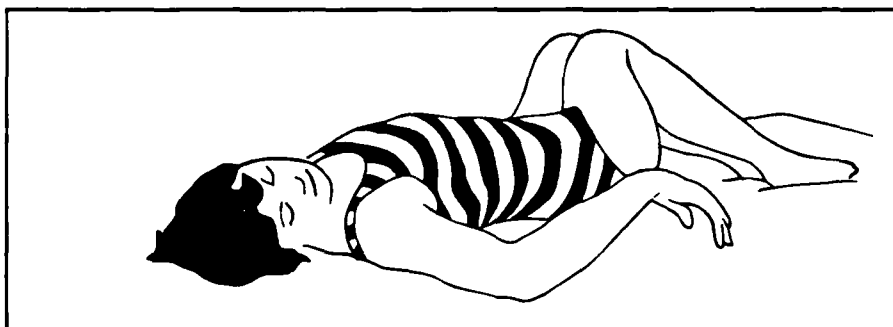
**PURPOSE:** *Develop smooth coordinated motion of multiple segments*

When the participant is adept at performing the above exercises, s/he progresses to more complicated movements. Examples include cervical rotation with symmetrical or asymmetrical glenohumeral rotation; cervical rotation with lower trunk or hip rotation in the opposite direction.

1



2





## STAGE II: SEGMENTAL MOTION OF THE SPINE AND UPPER QUADRANT, WITH EMPHASIS ON THE THORAX (WEEK 2)

The participant learns to isolate thoracic and scapular movement on a stable thorax. Also, s/he learns to coordinate movement of the glenohumeral, scapular, and thoracic regions on a stable pelvis. Emphasis is on isolation as opposed to quantity of movement.

### A. GOALS:

- Isolate thoracic movement on a stable pelvis
- Isolate scapular movement on the thorax
- Coordinate movement of the glenohumeral, scapular, and thoracic regions on a stable pelvis

### B. POSITION:

The participant lies on his/her side with hips flexed almost to 90 degrees to stabilize the pelvis and to allow rotation of the thorax relative to the pelvis.

### C. SPECIFIC EXERCISES:

Thorax

Scapula on the thorax

Scapula and thorax on a stable pelvis

### D. FUNCTIONAL MOBILITY TRAINING:

The participant practices reaching in different planes in sidelying. First s/he reaches straight across as if to reach for something at shoulder level. Next, s/he reaches up and across for something at head level.

The participant also practices segmental rolling. The participant should isolate movement at the pelvis, upper trunk and shoulder when rolling. Movement may be initiated by either upper or lower segments. This is repeated from side to side until smooth and continuous segmental rolling is achieved.

The participant practices moving from supine to and from sitting in a segmental fashion. S/he first rolls to the side, and then sits up, incorporating rotation and lateral flexion of the lumbar and thoracic spine.

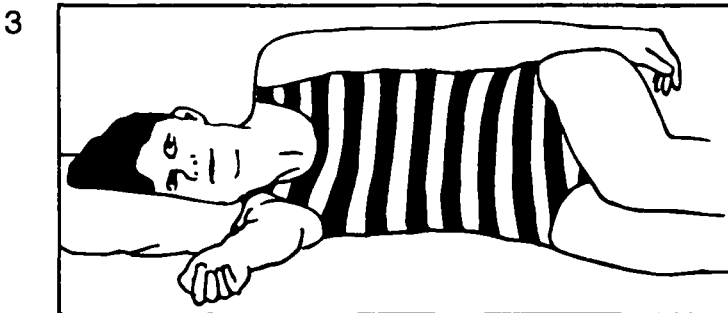
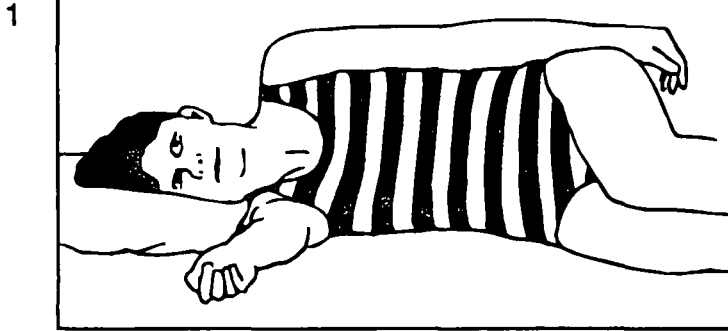
### E. CRITERIA FOR PROGRESSION:

- The participant can isolate scapular motion on the thorax
- The participant can isolate thoracic motion on the pelvis
- The participant can coordinate thoracic and upper extremity movement on a stable pelvis
- The participant can roll segmentally

**THORAX:**

**PURPOSE:** *To increase thoracic rotation*

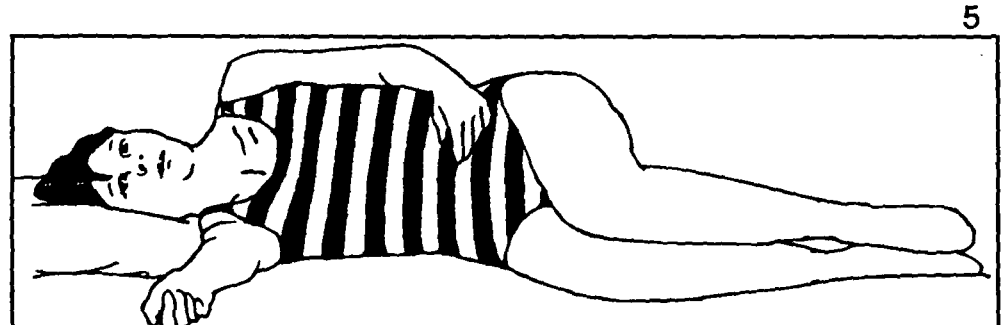
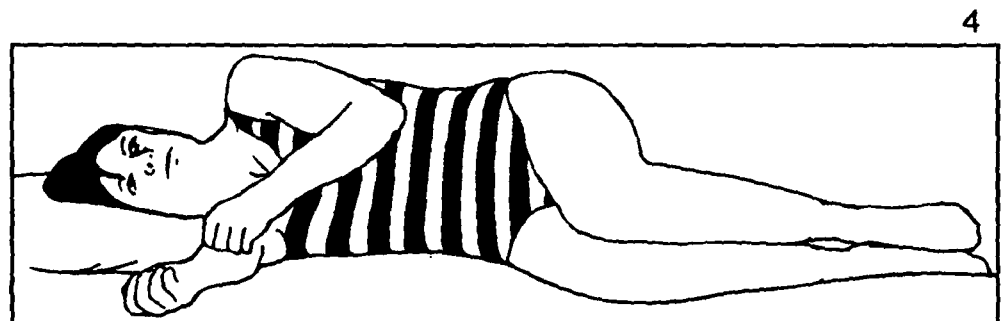
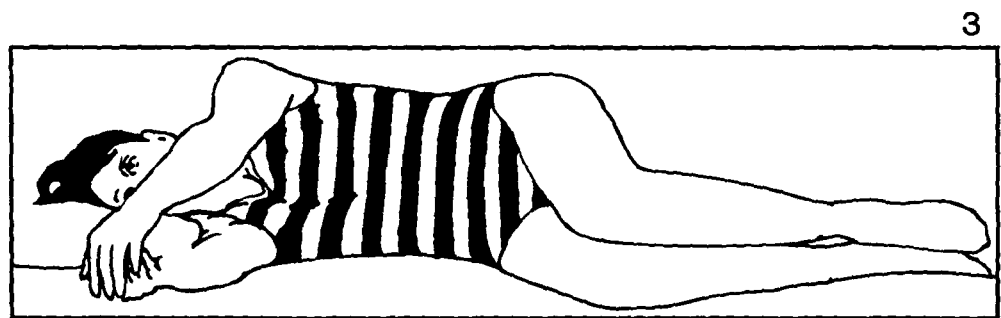
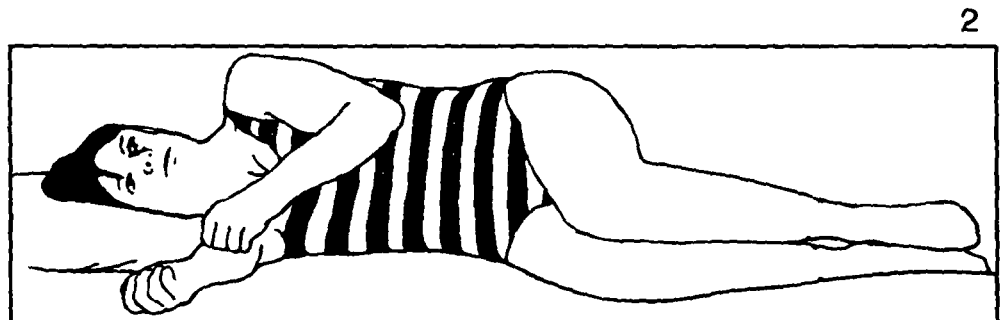
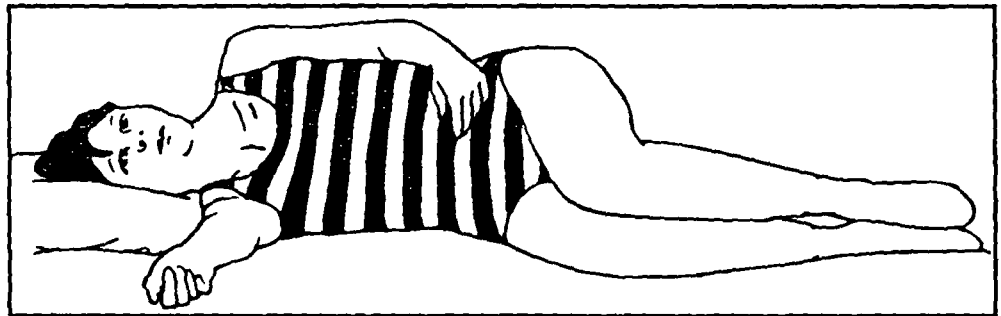
The participant practices movement of the thorax on the pelvis. The upper extremity should be positioned at the participant's side. S/he should move the thorax forward and then backward while the pelvis remains stabilized. The emphasis of movement is thoracic rotation with respect to a stable pelvis.



# SCAPULA ON THE THORAX:

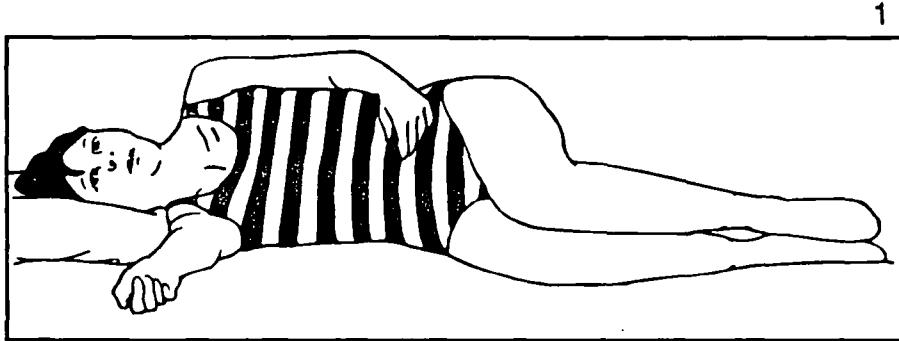
**PURPOSE:** To isolate scapular and glenohumeral motion without thoracic motion; To optimize orientation of the scapula and movement of the scapulo-thoracic joint

The participant reaches forward and backward with the arm while maintaining a stable thorax and pelvis. The scapula should glide smoothly on the thorax. The arm remains in the sagittal plane of the body avoiding abduction. The elbow may be flexed and/or extended but should remain relaxed during this exercise.

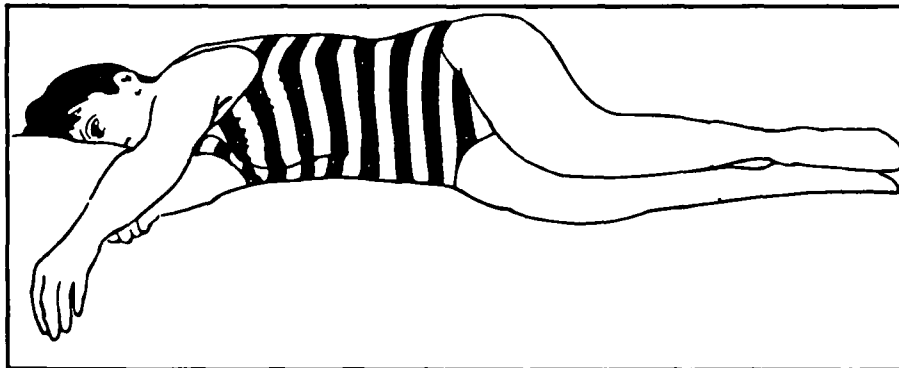


# SCAPULA AND THORAX ON A STABLE PELVIS: (a combination of the previous two exercises.)

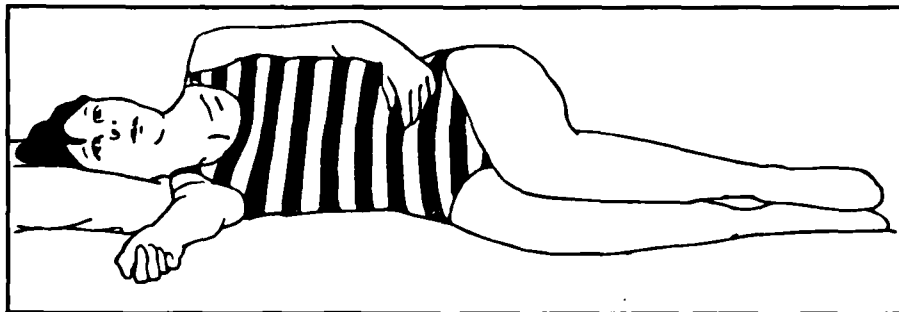
**PURPOSE:** To coordinate glenohumeral and thoracic motion



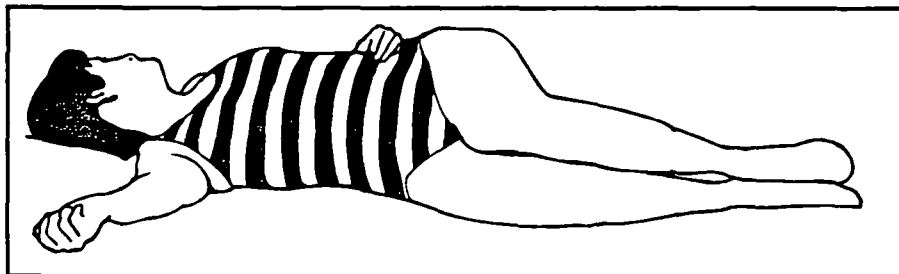
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The participant reaches forward and backward with the humerus in the sagittal plane of the body. The movement should include thoracic rotation with respect to a stable pelvis. This movement is a combination of the previous two exercises, building on the range of motion and isolated movement gained. The motion of the thorax and upper extremity should be smooth and coordinated while the pelvis remains relatively stable. As the participant gains scapulothoracic motion, s/he may reach in various planes as long as the upper extremity remains relaxed and abduction of the extremity is avoided.

## STAGE III: SEGMENTAL MOTION OF THE SPINE AND ISOLATED MOTION OF THE LOWER EXTREMITIES ON A STABLE PELVIS: PRONE (WEEK 3)

This stage introduces the motion of flexion/extension of the spine in the prone position.

### A. GOALS:

- Assume a symmetric prone position
- Increase thoracic and lumbar extension
- Isolate internal and external rotation of the lower extremities on the pelvis
- Increase hip internal and external rotation range of motion

### B. POSITION:

The participant lies prone with pillows or towels under the head, chest and abdomen as needed in order to provide optimal alignment and relaxation. The participant may want to begin by resting several minutes in this position.

### C. SPECIFIC EXERCISES:

“Wiggle”

Prone on elbows

Internal/external hip rotation

### FUNCTIONAL MOBILITY TRAINING:

The participant practices segmental rolling, all the way to prone from supine, and back to prone.

### D. CRITERIA FOR PROGRESSION:

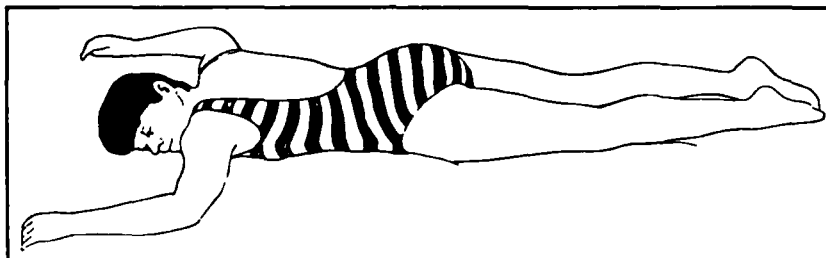
- The participant is able to independently assume a prone position
- The participant demonstrates lumbar and thoracic extension through visible ranges in prone and prone on elbows

**"WIGGLE":**

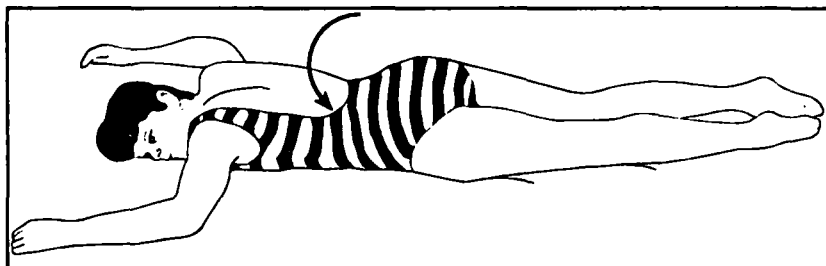
**PURPOSE:** Promote relaxation of the spine and pelvo-femoral area in preparation for extension exercises

The participant gently "wiggles" the pelvis rhythmically and in a relaxed manner to the right and left to achieve movement and relaxation of the lower back and axial structures. The emphasis of this motion is on rotation of the lumbar and low thoracic region.

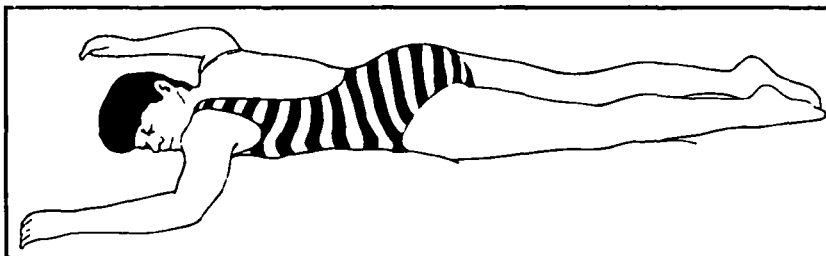
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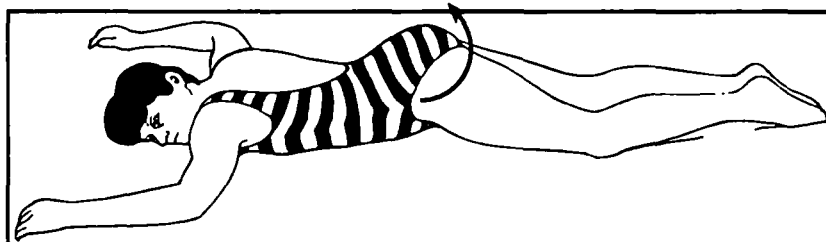
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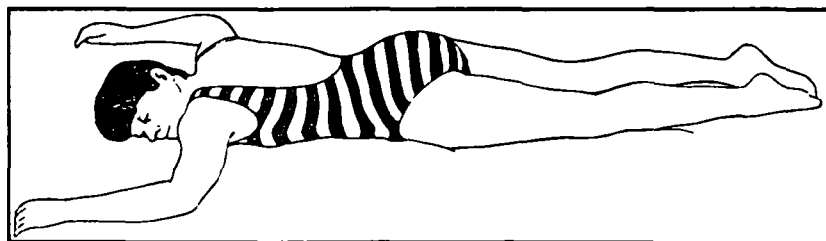
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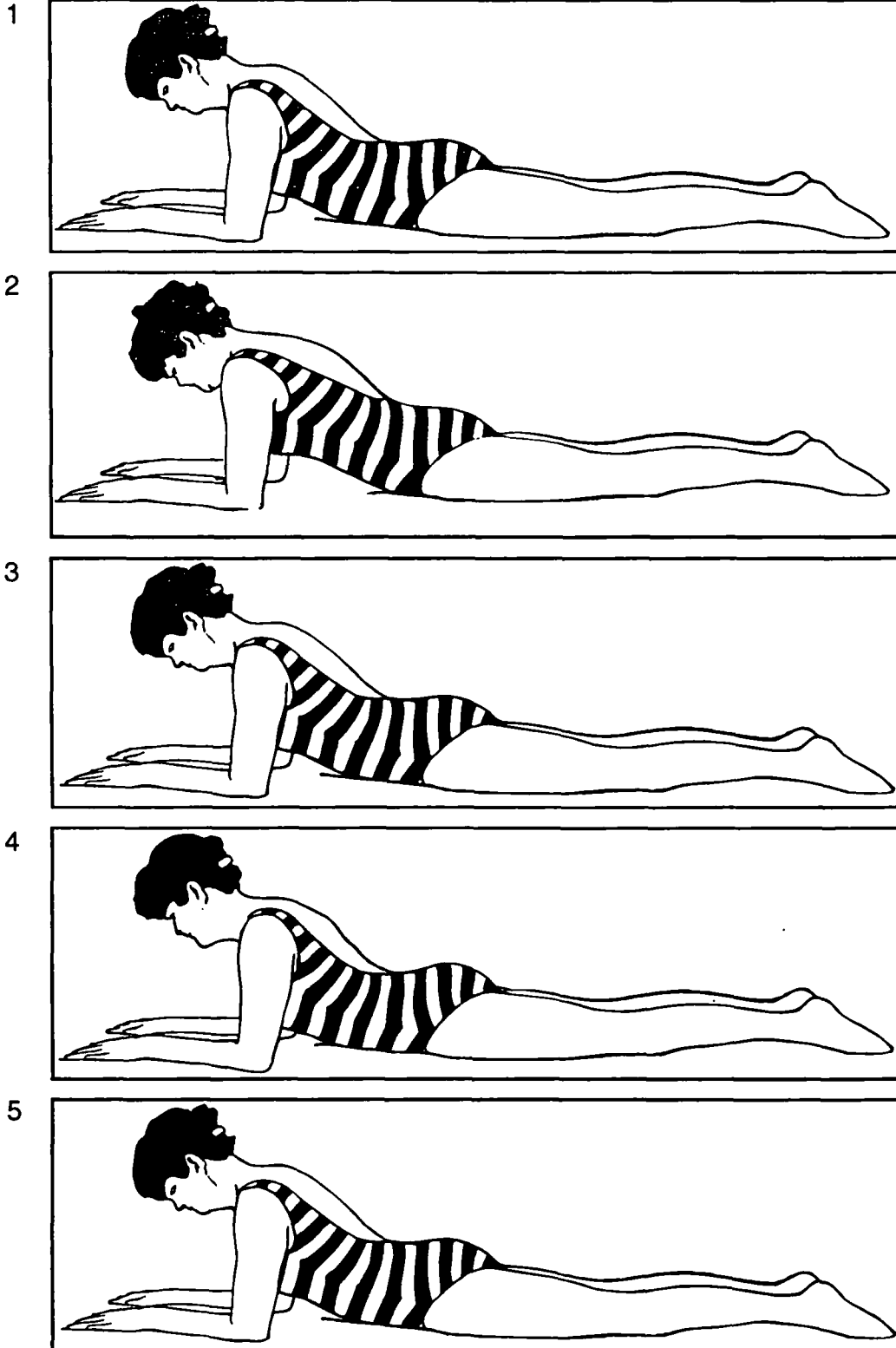


## PRONE ON ELBOWS:

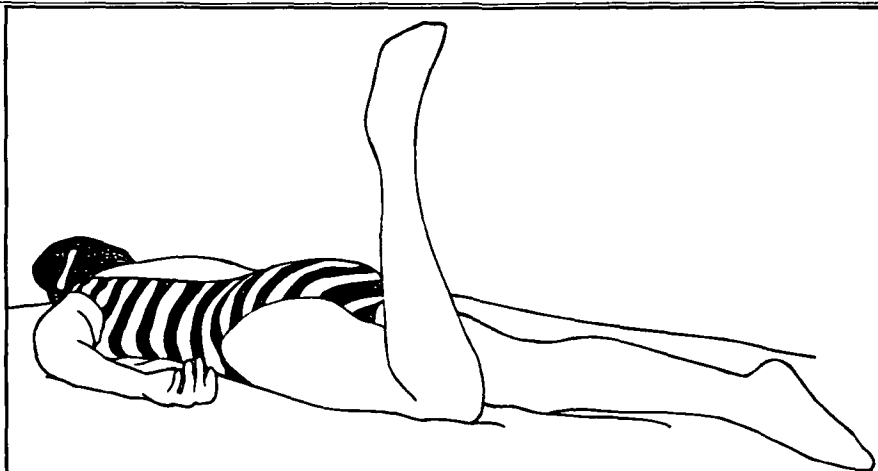
**PURPOSE:** To increase flexion and extension of the thoracic and lumbar spine

The participant lies prone on elbows to promote increased lumbar and thoracic extension. The participant's elbows should be directly under the glenohumeral joint for maximum support. S/he should attempt to maintain a relaxed thoracic region in the static position. When this position is

comfortable and tolerated, the participant then begins to move from a position of thoracic flexion to thoracic extension. It may be helpful to have the participant inhale deeply to passively place the thoracic region in flexion and then exhale to passively obtain thoracic extension. Gentle pressure on the sternum in an upward direction may facilitate flexion. Gentle pressure over the thoracic spine may facilitate extension. Downward pressure over the thoracic spine may facilitate extension.



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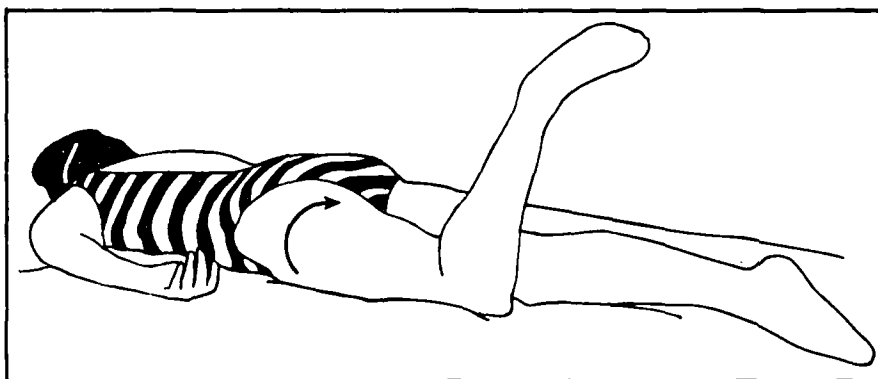


# **INTERNAL/EXTERNAL HIP ROTATION:**

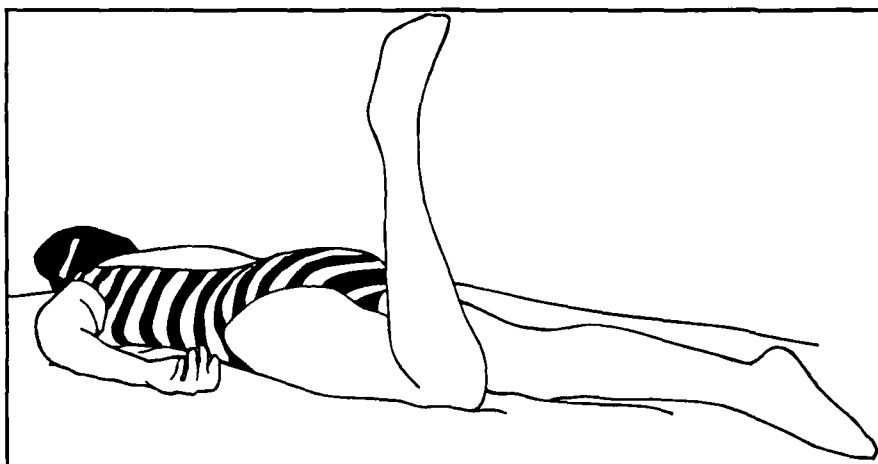
**PURPOSE:** *To relax the internal and external hip rotators and to increase range of motion*

The participant lies in a prone position with both hips extended and one knee flexed. S/he then slowly internally and externally rotates the hip. The pelvis should remain stationary, so that isolated hip internal and external rotation is achieved.

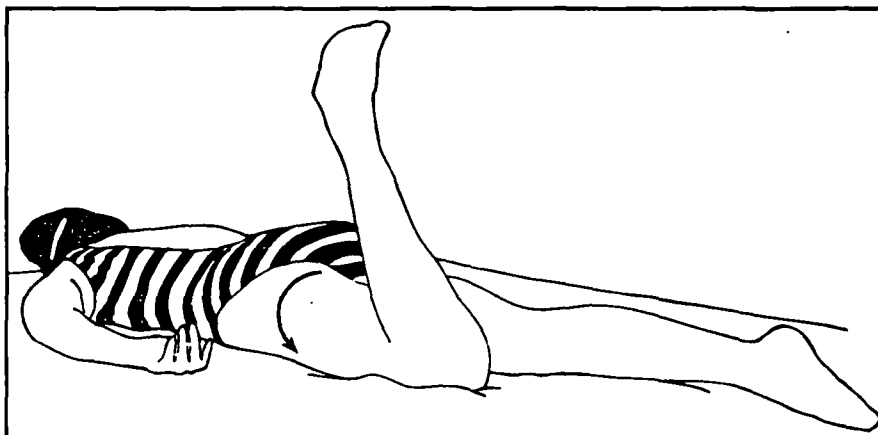
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## STAGE IV: SEGMENTAL MOTION OF THE SPINE AND PELVIS: QUADRUPED (WEEKS 4 & 5)

The participant performs flexion/extension movements of the spine in a less supported position than in the previous stages. The less supported position allows for greater ranges of movement of the spine. This less supported position also adds new demands for coordinated movement.

### A. GOALS:

- Increase mobility in the lumbar, thoracic, and cervical regions
- Isolate motion throughout the spine
- Coordinate dynamic movement of the shoulders, hips and spine

### B. POSITION:

The participant assumes the quadruped position on hands and knees with the spine in a neutral position. The hands should be slightly forward of the glenohumeral joints with the knees directly underneath the hips.

### C. SPECIFIC EXERCISES:

Cat/Camel

Isolated flexion/extension of the lumbar region

Rocking forward and backward in the sagittal plane

Rocking forward and backward in the diagonal plane

### D. FUNCTIONAL MOBILITY TRAINING:

The participant begins floor to stand transfers, moving from quadruped to kneeling, to half kneeling to standing. Emphasis is on transfer of body weight forward and diagonally over the forward foot in half kneeling as the participant rises. The participant may push with upper extremities from his/her knee or from a supporting surface.

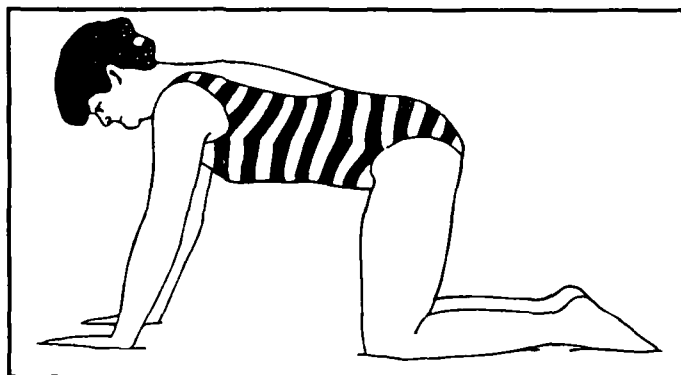
### E. CRITERIA FOR PROGRESSION:

- The participant assumes the quadruped position with good alignment
- The participant increases flexion/extension range of motion throughout the spine
- The participant isolates motion in the pelvic, lumbar, thoracic, and cervical regions

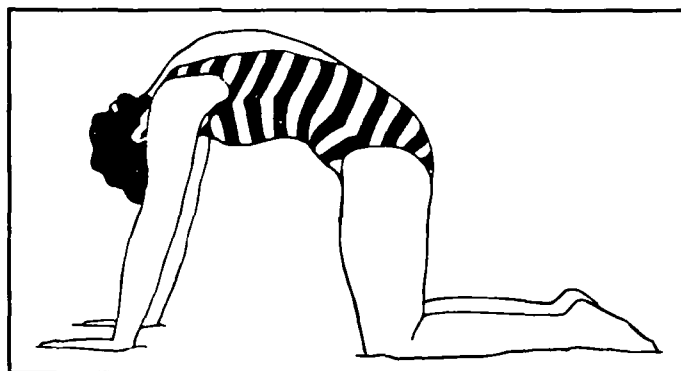
**CAT/CAMEL:**

**PURPOSE:** Increase range of motion and control of extension and flexion of the entire spine

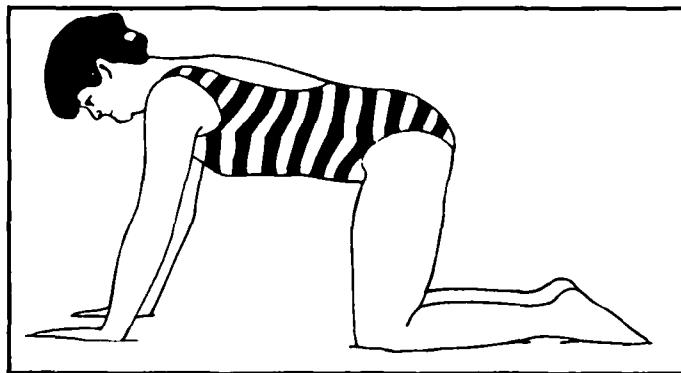
The participant moves his/her total spine as a unit into flexion and extension (the cat and camel position). This should be repeated several times so that the client may "feel" movement. It is common for participants to demonstrate excessive flexion of the thoracic spine while being limited in extension. Both flexion and extension may be limited in the lumbar spine as well. For these reasons, excessive thoracic kyphosis should be avoided during this exercise, especially in participants who have minimal movement in the lumbar spine. The goals of the exercise are to improve mobility throughout the spine and to relax the thoracic region.



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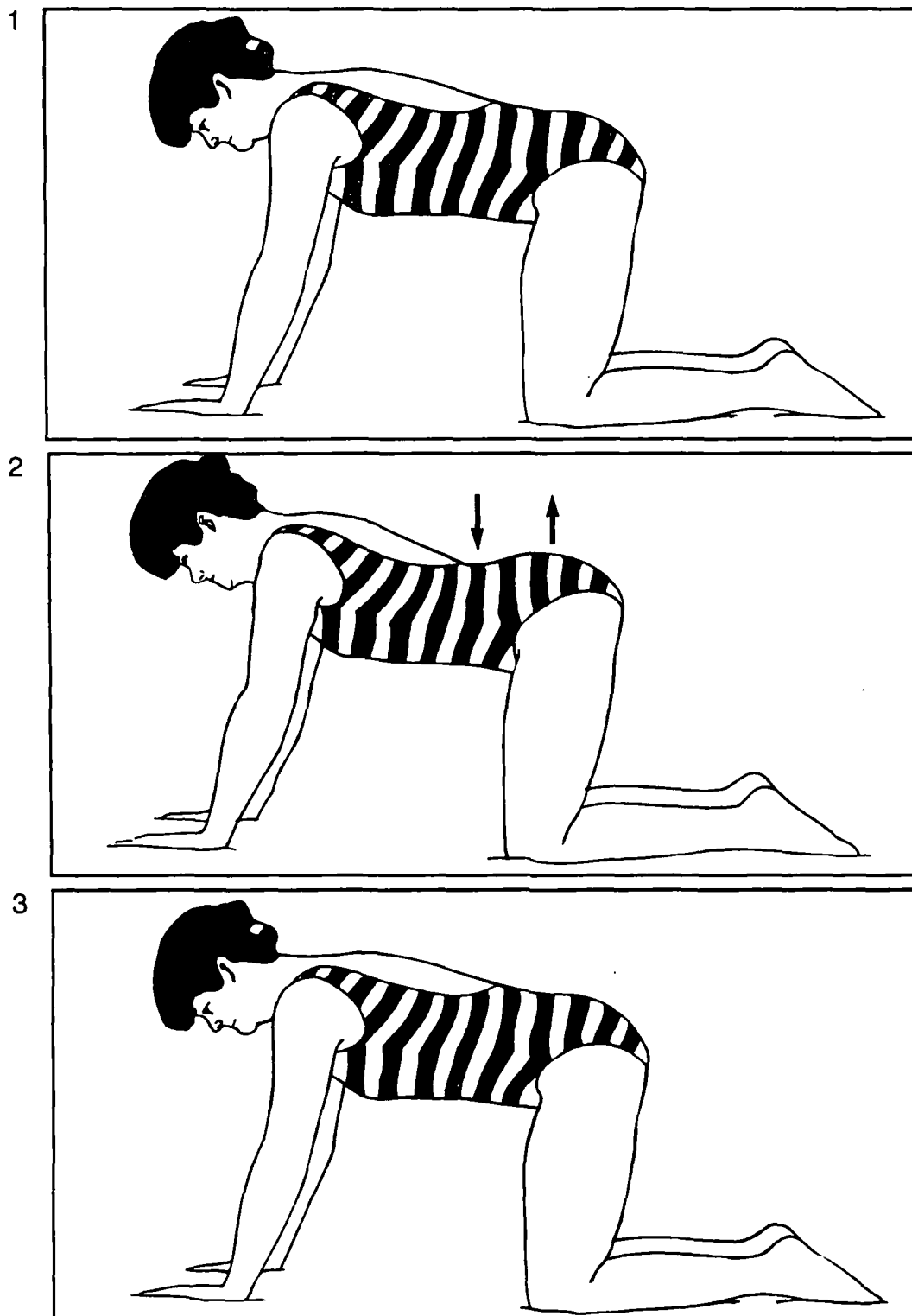


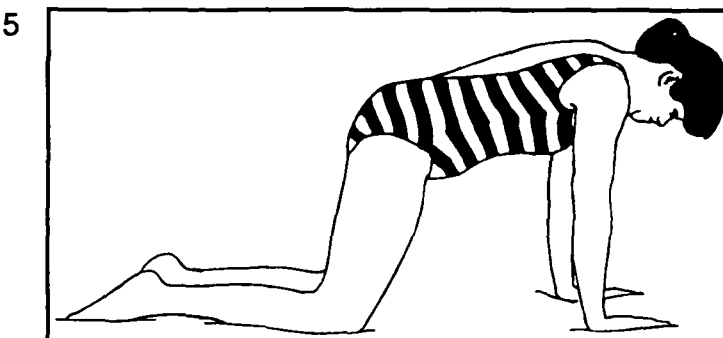
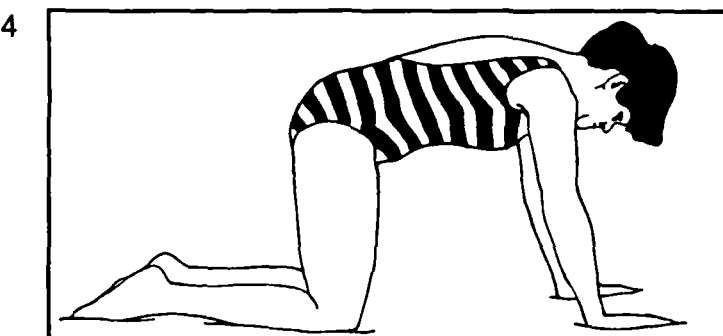
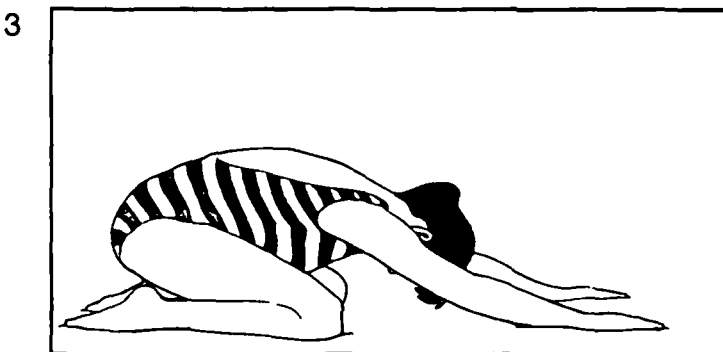
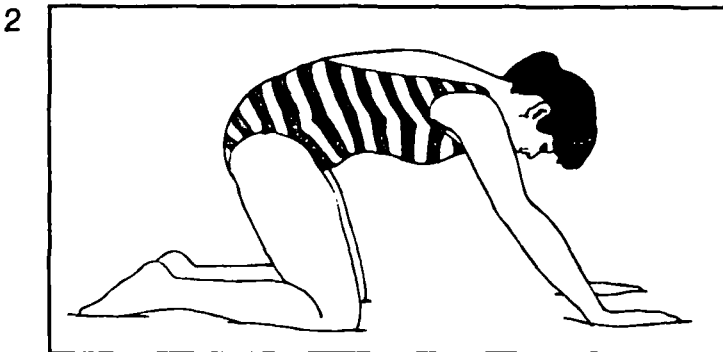
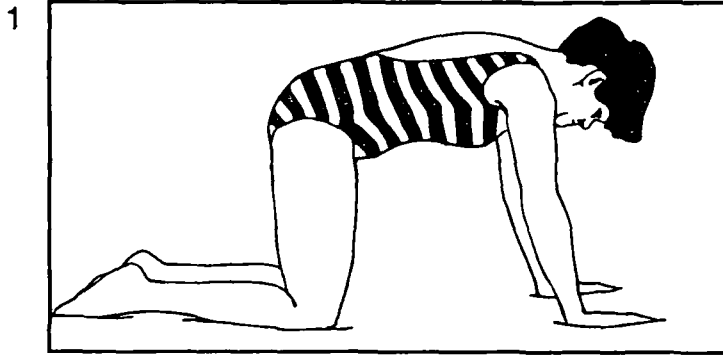
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**ISOLATED FLEXION/EXTENSION OF THE LUMBAR REGION:**

*PURPOSE: Isolate motion of the lumbar spine and of the thoracic spine*

The participant assumes the neutral quadruped position. S/he performs isolated lumbar motion by anteriorly and posteriorly tilting the pelvis while the thoracic region remains stationary. The motion may initially be very small, but it is important that isolated movement is obtained.





## ROCKING FORWARD AND BACKWARD IN THE SAGITTAL PLANE:

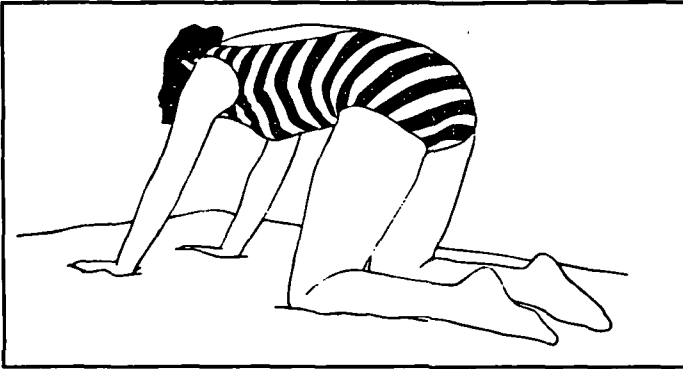
**PURPOSE:** *Stretch the soft tissue structures of the low back, pelvis, hip and shoulder; Increase coordinated movement in less supported positions*

The participant assumes a neutral quadrupedal position, with elbows extended and slowly rocks backward and forward. Neutral alignment of the spine should be retained throughout the exercise. The weight shift forward is usually just enough to align the hands under the shoulders. Initially, this exercise should be performed slowly and in small ranges. The emphasis of the exercise is on a smooth and continuous movement of the center of mass forward and back.

As the axial musculature and tissues lengthen, the movement forwards and backwards may increase. The instructor may need to limit the amount of movement backwards (depending on the status of the lower thoracic and lumbar region) and the amount of movement forwards (depending on the status of the glenohumeral joints.) The participant may need to move his/her hands forward to allow more movement and minimize stress to the shoulders. As the axial musculature and tissues lengthen, the movement forwards and backwards may increase. The instructor may need to limit the amount of movement backwards (depending on the status of the lower thoracic and lumbar region) and the amount of movement forwards (depending on the status of the glenohumeral joints.) The participant may need to move his/her hands forward to allow more movement and minimize stress to the shoulders.

Some participants may be able to perform an advanced variation of this exercise by moving from quadrupedal to and from prone in a segmental fashion.

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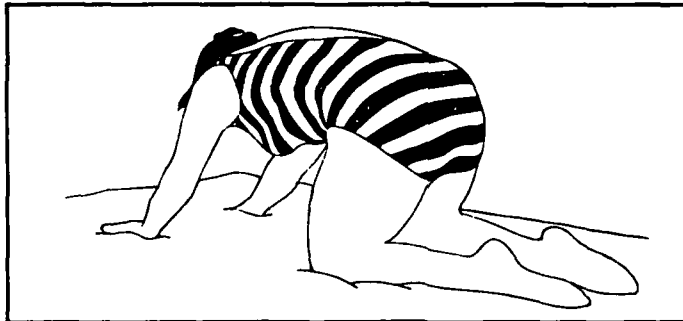


## ROCKING FORWARD AND BACKWARD IN THE DIAGONAL PLANE:

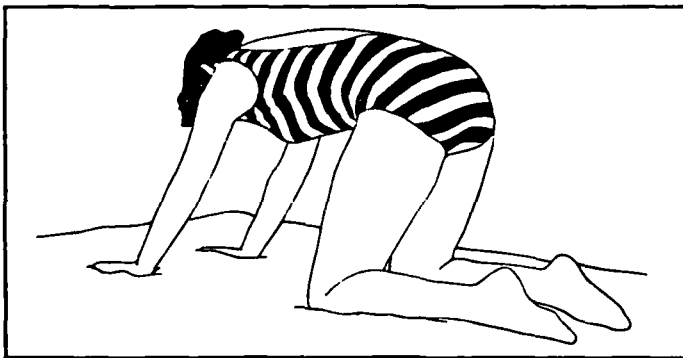
**PURPOSE:** *Stretch the lateral soft tissue structures of the thorax, pelvis, hip and shoulder; Increase coordinated movement in less supported positions*

The participant assumes the neutral quadrupedal position. S/he performs the rocking motion described in the previous exercise but the motion is on a diagonal from one hip to the opposite shoulder. The emphasis of the movement is to move the center of mass diagonally over the hip to stretch and lengthen the posterior-lateral structures of the hip, pelvis, and lower back, and then to return to a neutral glenohumeral position. Be careful not to place excessive stress on the glenohumeral joint.

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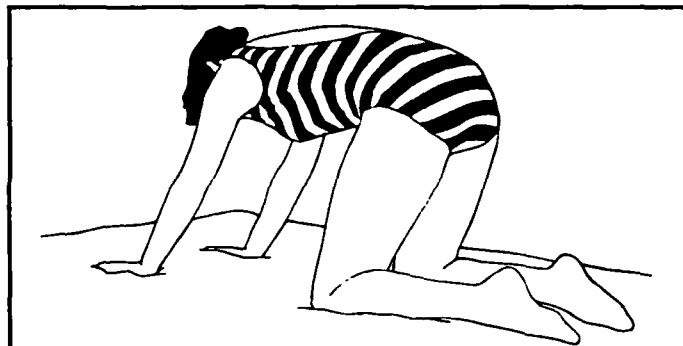
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## STAGE V: SEGMENTAL MOTION OF THE SPINE AND PELVIS: SITTING (WEEKS 6&7)

In this stage of the program, the participant isolates individual segments in an upright position. Emphasis is on isolated lumbo-pelvic motion with an extended thoracic spine. The sitting position is used here to increase the difficulty of the task without introducing the demands for balance control that occur in standing.

### A. GOALS:

- Assume an erect sitting posture with neutral alignment
- Increase lumbar flexion and extension in the unsupported position
- Isolate and coordinate lumbo-pelvic motion in unsupported sitting

### B. POSITION:

The participant assumes neutral alignment in sitting. Blocks may be placed under the feet or pillows in the chair, in order to obtain the proper hip, knee and ankle position.

### C. SPECIFIC EXERCISES:

Isolated anterior/posterior pelvic tilt  
Forward trunk flexion over a stable pelvis  
Diagonal trunk flexion over a stable pelvis  
Lateral pelvic tilt  
Pelvic clock  
Chin tucks/cervical motion  
Flexion/extension roll

### D. FUNCTIONAL MOBILITY TRAINING:

The participant practices coming from sitting to standing with good mechanics and smooth coordinated movement. Emphasis is on maintaining neutral alignment of the spine throughout the task. It is important to practice this task under a variety of conditions such as varied speeds, chair heights, and use of the upper extremities.

### E. CRITERIA FOR PROGRESSION:

- The participant maintains an erect and neutral sitting posture
- The participant demonstrates A/P movement of the lumbar spine and pelvis
- The participant is able to stabilize the torso while moving the pelvis in forward, lateral, and diagonal planes

# ISOLATED ANTERIOR/POSTERIOR PELVIC TILT:

**PURPOSE:** Increase lumbo-pelvic motion; stabilize the thorax in an upright position while moving the pelvis

The participant will perform an A/P pelvic tilt, with the emphasis on isolated pelvic movement. The shoulders should be held relatively stationary over the greater trochanters while the pelvis is rotated forward and back

ward. Verbal and tactile cues may be indicated until the concept is understood. It is frequently helpful for the instructor to place their hands over the lateral aspects of the pelvis and/or on the lumbar spine. One technique that may help the participant to recognize motion in the lumbar region, is to have her/him assume a slouched position, and then to sit erect with emphasis on slight lumbar extension.

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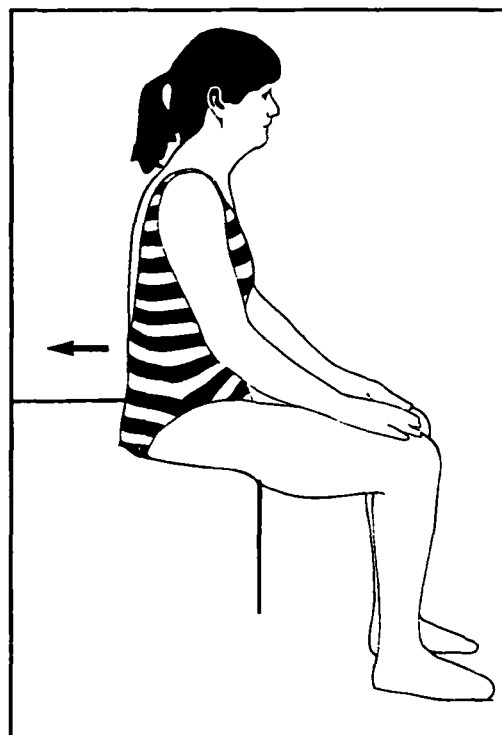
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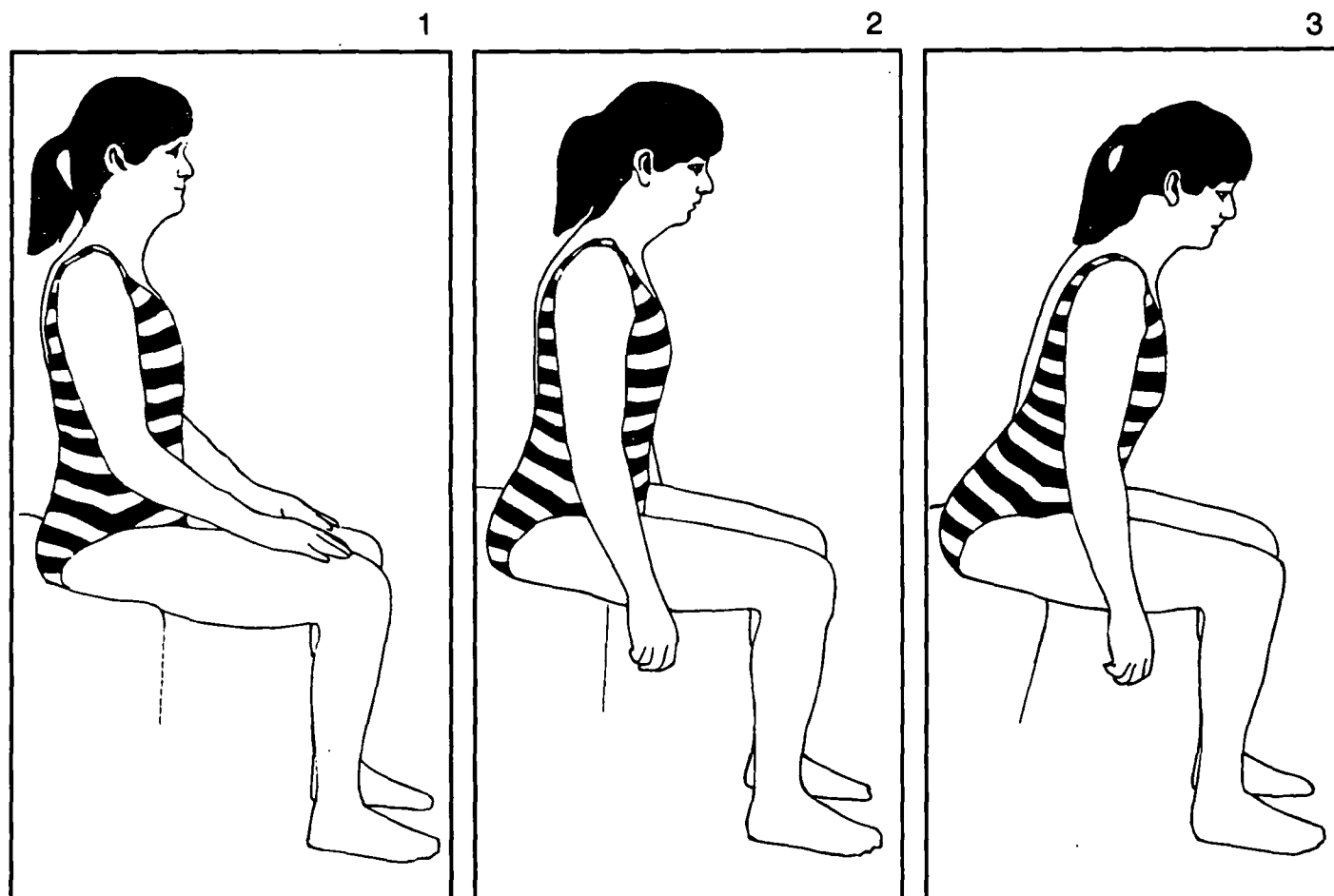
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**FORWARD TRUNK FLEXION OVER A STABLE PELVIS:**

**PURPOSE:** Increase hip extensor muscle length; develop the ability to maintain neutral trunk alignment while moving the trunk in relation to the hips

The participant retains a neutral posture of the cervical, thoracic, and lumbar spine. The participant stabilizes the torso so that neutral alignment is maintained as the participant flexes forward over the femurs. The goal is to maintain extension of the spine while flexing the hips. Initially, this exercise should be performed through small ranges; as more motion is obtained in the pelvic region, the movement may increase.

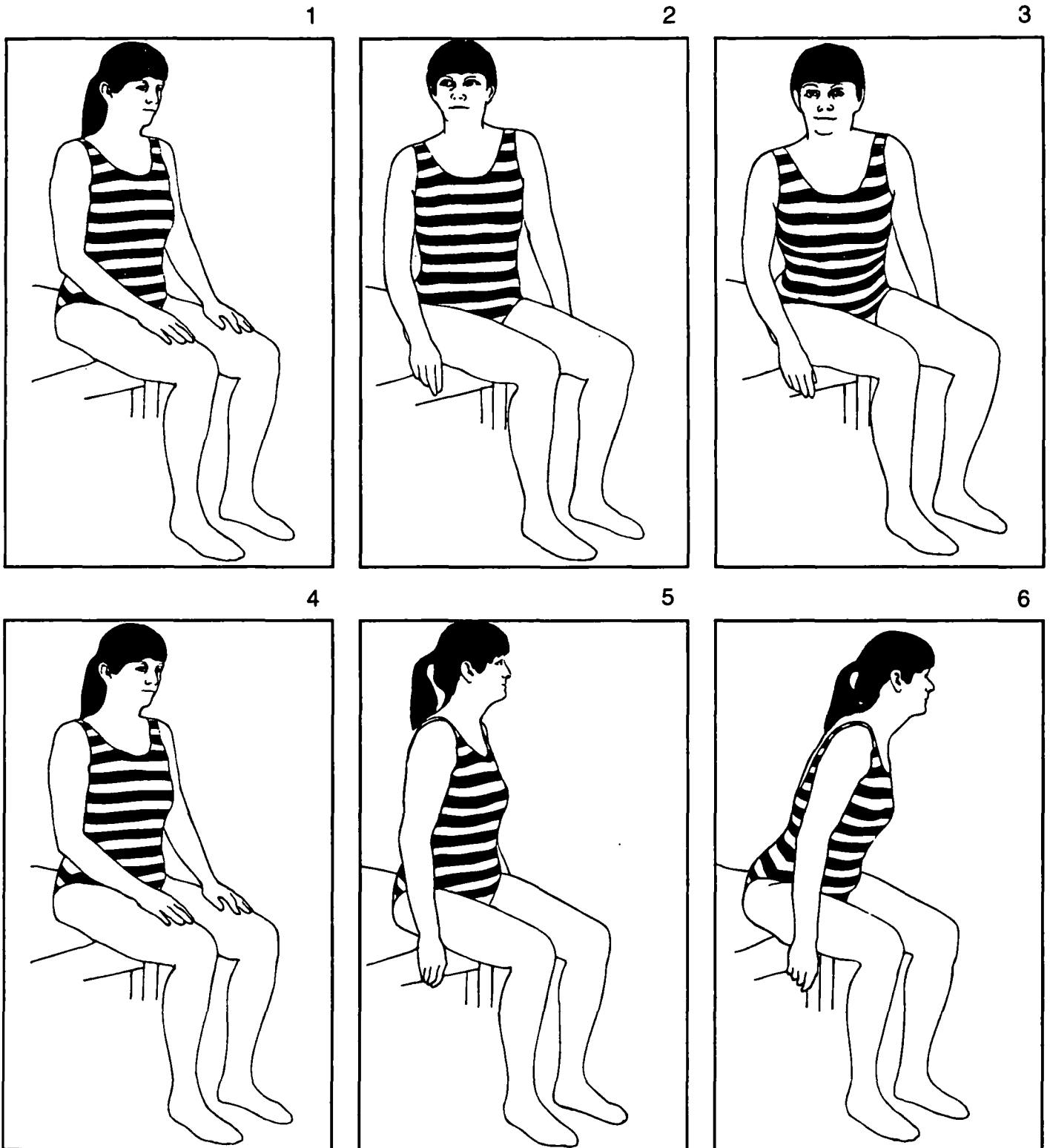




**DIAGONAL TRUNK FLEXION OVER A STABLE PELVIS:**

**PURPOSE:** Increase hip ab/adduction and extensor range of motion; increase the ability to coordinate complex lumbo-pelvic motion; Increase balance control through small displacements of the trunk

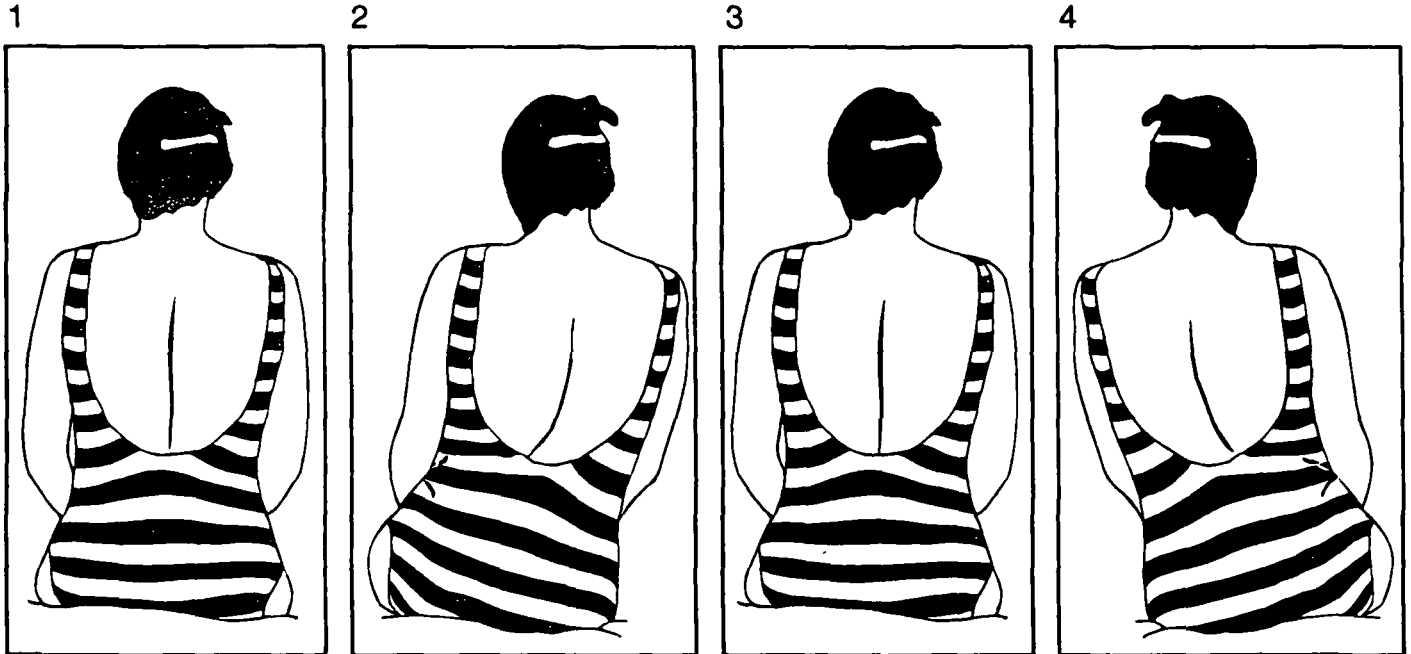
The participant rotates the pelvis the entire trunk to the right, and allows his/her weight to shift to the right buttock. S/he flexes the trunk forward over the right femur in a diagonal plane. The thorax is stabilized as in the previous exercise. Repeat the movement to the left.



**LATERAL TILT OF THE TRUNK AND PELVIS:**

**PURPOSE:** *To isolate lumbar lateral flexion in sitting*

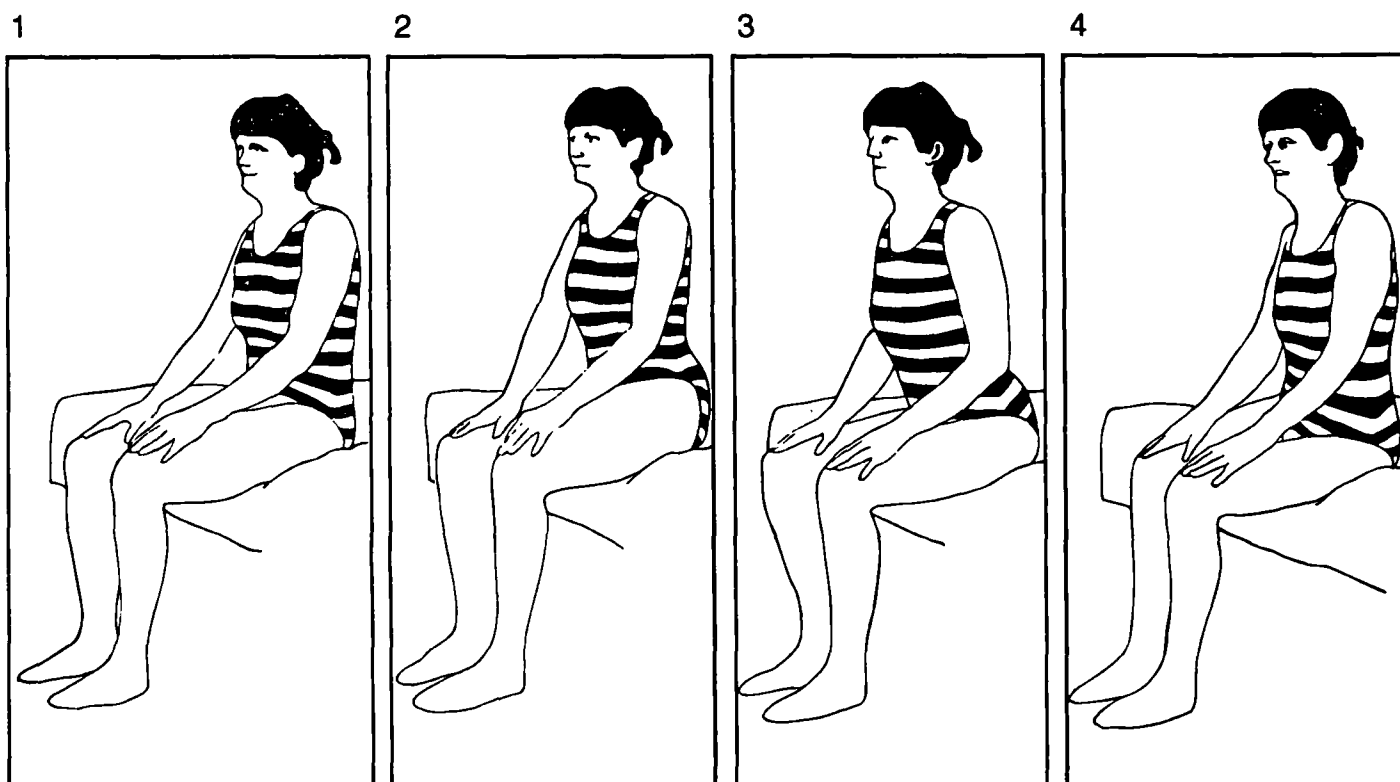
The participant shifts weight onto one buttock and allows the opposite buttock to unweight from the supporting surface. The trunk remains straight without rotation or movement in the sagittal plane.



**PELVIC CLOCK:**

**PURPOSE:** *Isolated pelvic movement in all planes in sitting*

The participant sits in good alignment and begins to rotate the pelvis in a clockwise direction, moving into a posterior pelvic tilt, a lateral pelvic tilt, an anterior pelvic tilt and a lateral pelvic tilt to the opposite side. This is repeated several times in a smooth and coordinated manner. The participant then repeats the motion in a counter-clockwise direction.



## CHIN TUCKS/CERVICAL MOTION:

**PURPOSE:** *Improve head/neck alignment and mobility*

Once the participant can align the thorax over the pelvis, s/he should work on cervical alignment and mobility. If the participant has a forward head posture, s/he should perform chin tucks to bring the cervical spine into a neutral alignment. This is achieved by dropping the chin slightly, and drawing the chin in towards the spine. Also begin lateral flexion and rotation with the emphasis on good alignment and posture.

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## STAGE VI: COORDINATED TRUNK AND UPPER EXTREMITY MOVEMENT IN AN UNSUPPORTED POSITION (SITTING) (WEEK 8).

The participant performs complex and coordinated movements of the lumbar, thoracic and cervical regions in the unsupported sitting position. Good posture must be maintained during all of these movements.

### A. GOALS:

- The participant will perform coordinated movements of bilateral upper extremities and trunk
- The participant will maintain an erect posture and will shift weight from the pelvis as the movement is performed

### B. POSITION:

The participant assumes the position stated in the previous stage.

### C. SPECIFIC EXERCISES:

Trunk rotation  
Trunk extension *from a flexed position*  
Trunk flexion and extension in the diagonal plane

### D. FUNCTIONAL MOBILITY TRAINING:

1. The participant will practice putting on shoes and socks using trunk and hip flexion while keeping the pelvis in neutral.

#### 2. Sitting Reach:

The participant sits in neutral alignment and reaches forward, diagonally to the left and right, and posteriorly. He/she also combines reaching forward to one side and then posteriorly to the opposite side to increase trunk rotation. Each pattern should be practiced with each upper extremity. Movement should involve coordinated scapular protraction and retraction, trunk flexion, extension, and rotation to both sides. Smooth weight transfer should occur.

### E. CRITERIA FOR PROGRESSION:

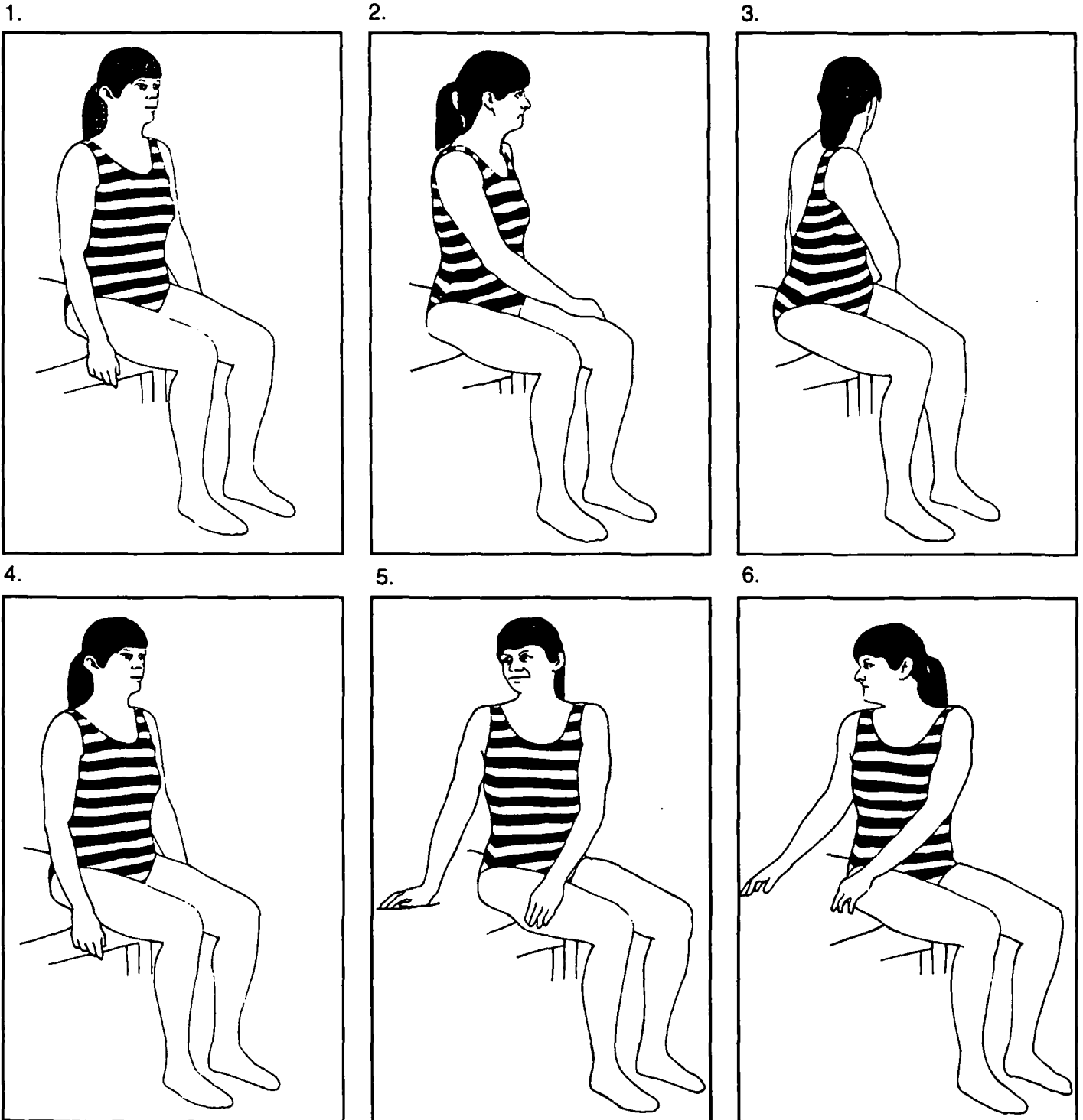
- The participant should be able to perform these exercises efficiently with occasional verbal or tactile cues. S/he must be able to properly execute the movement with good posture and alignment
- The participant coordinates transverse plane motions of the thorax and pelvis while retaining an erect posture

**TRUNK ROTATION:**

**PURPOSE:** *Develop range of motion and control in the transverse plane*

The participant practices rotation to the left and right while maintaining an erect spine. Symmetrical weight

shift at the pelvis should accompany this movement. The participant may practice shifting weight to the contralateral and ipsilateral sides while rotating. The arms may be cradled over the abdomen or allowed to hang freely by the sides as shown below. The participant should involve the entire spine, shoulders and pelvis in the motion. Verbal cues to look behind him/herself can help incorporate all segments.

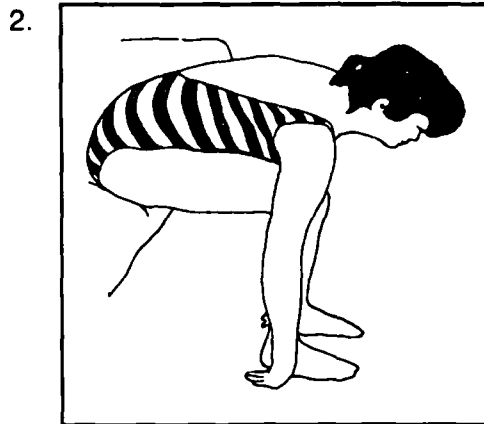
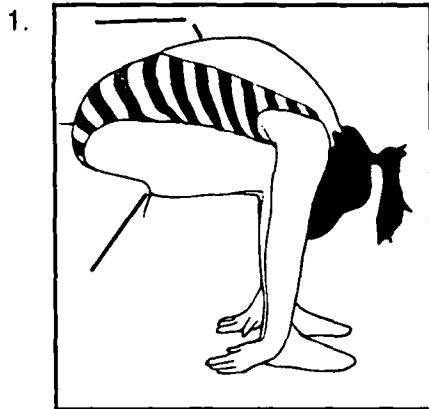


## TRUNK EXTENSION FROM A FLEXED POSITION:

**PURPOSE:** *Segmental extension*

The participant relaxes into flexion allowing his/her hands to comfortably fall near his/her feet. S/he then extends the spine in the following order: first, the cervical

spine; second, the thoracic spine (the participant does this by raising the arms and adducting the scapulae without shrugging the shoulders); third, the lumbar spine. The participant completes the motion in a position of full extension, with a lumbar lordosis if possible. The upper extremities may be held overhead, or with the shoulders in a position of 90 degrees of abduction and external rotation. The participant should practice this exercise until smooth coordinated movement of all segments occurs.

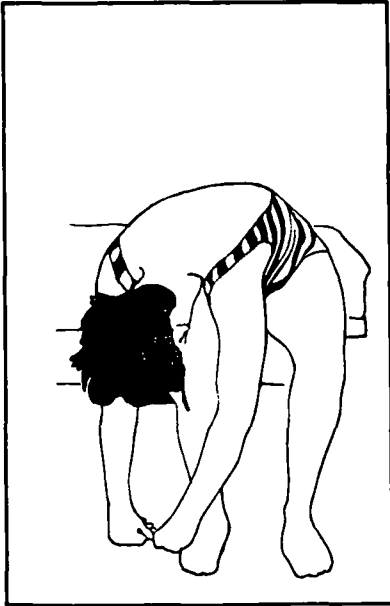


# TRUNK FLEXION AND EXTENSION IN THE DIAGONAL PLANE:

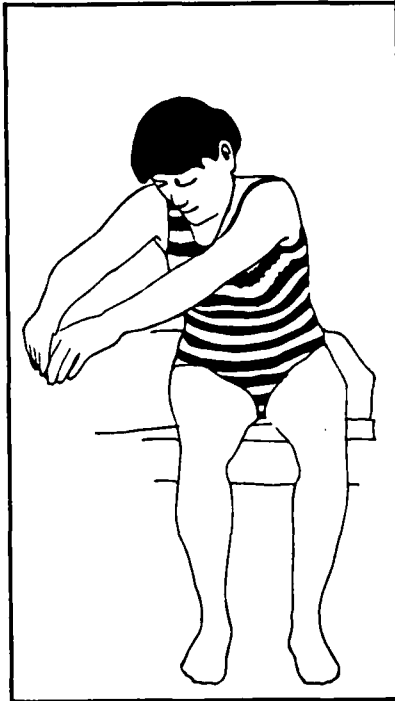
**PURPOSE:** Coordinated trunk extension ,rotation, and weight shift.

The participant flexes and rotates the trunk and positions his/her hands on the outside of his/her right or left foot. S/he then fully extends and rotates the trunk while reaching both upper extremities over the opposite shoulder.

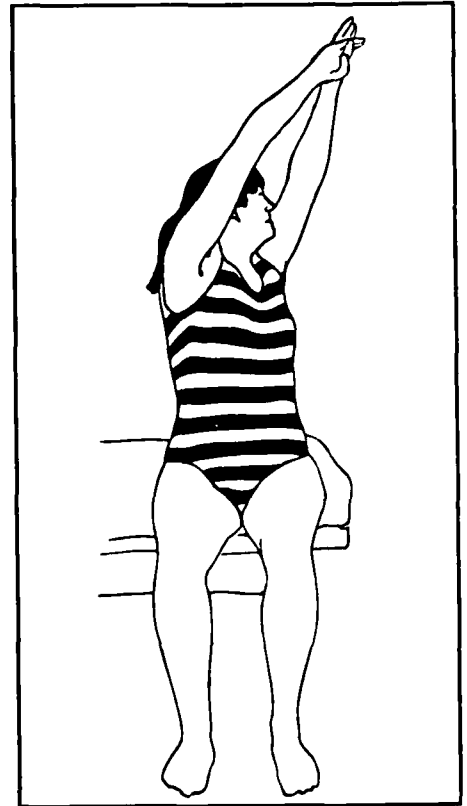
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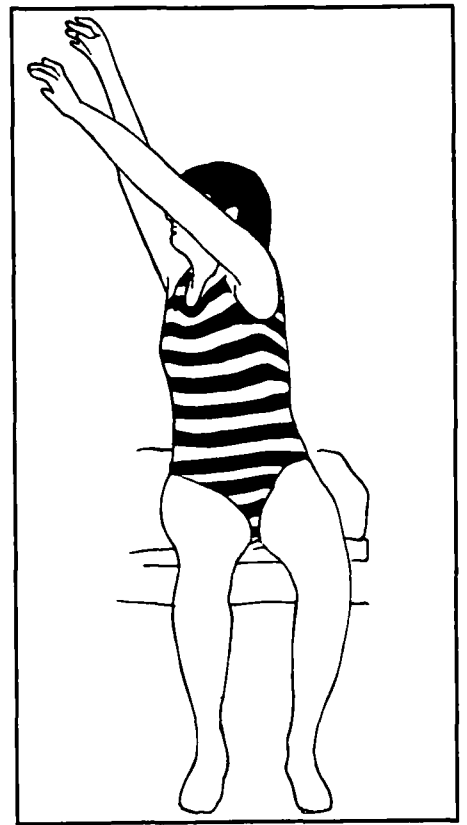
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## STAGE VII: AXIAL MOBILITY IN STANDING (WEEKS 9 - 12)

This stage progresses the participant to dynamic and coordinated movements in standing. The movements should be performed in a relaxed manner with good posture and alignment. Music may be a good adjunct to this aspect of the program. There are four categories of exercises.

### A. GOALS:

- The participant utilizes the axial and segmental motion gained from the previous stages for coordinated dynamic movement in standing
- The participant performs isolated and coordinated motions at all spinal segments and regions.

### B. POSITION:

The participant should stand with shoes on in an open area. S/he should perform all the exercises while maintaining good alignment throughout the axial region. Some of these exercises should be performed using one or two chairs with a back height tall enough to allow the participant to be able to rest a hand on the frame for support.

### C. SPECIFIC EXERCISES:

#### I. GENERAL LUMBO-PELVO-FEMORAL MOTION

- Lateral trunk flexion
- Relaxed trunk and lower extremity rotation

#### II. ISOLATED LUMBO-PELVO-FEMORAL MOTION

- Isolated lower trunk rotation
- Isolated upper trunk rotation
- Lateral pelvic tilt in standing
- Standing pelvic clock

#### III. INITIATING MOVEMENT WITH THE PELVIS

- Forward and backward weight shifts

### D. FUNCTIONAL MOBILITY TRAINING

#### 1. Standing Reach

The participant practices reaching forward as if to touch an object in front of him/her. S/he also reaches diagonally and upward as if to reach an object on a shelf. Movement should incorporate weight transfer, trunk rotation and scapular protraction in a smooth coordinated fashion. The participant may also practice reaching straight up as if to turn on a ceiling fan.

#### 2. Putting on a jacket

The participant practices putting on and taking off a jacket or shirt. Movement should incorporate weight shift, trunk rotation and scapular retraction.

## LATERAL TRUNK FLEXION:

**PURPOSE:** *To lengthen soft tissues of the lateral trunk*

The participant stands in an open area and slowly laterally flexes the trunk and head without forward flexion, extension or rotation. S/he should begin by allowing the

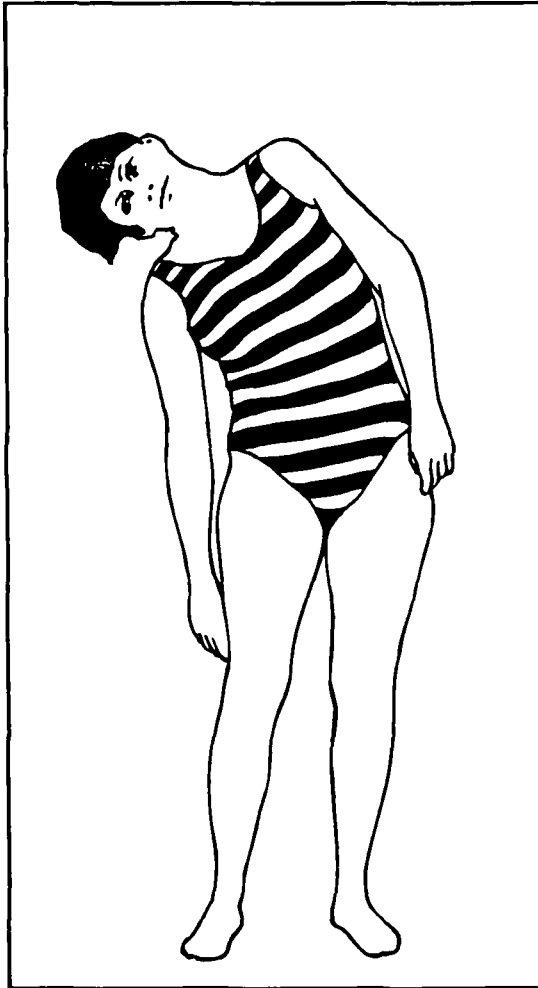
ear to drop toward the shoulder and then following with the thoracic and lumbar regions, allowing the hand to gently slide towards the knee.

The participant may perform a more advanced form of this exercise by reaching overhead with the opposite upper extremity, thus allowing additional trunk elongation.

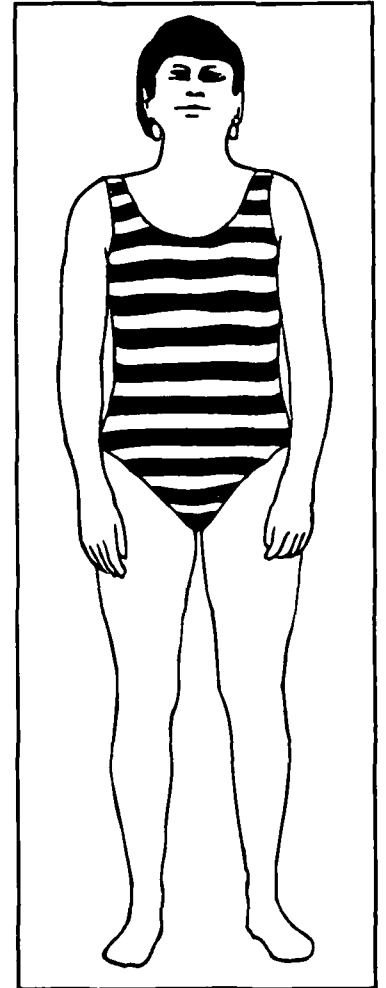
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**RELAXED TRUNK AND LOWER EXTREMITY ROTATION:**

**PURPOSE:** *To achieve relaxed rotation in standing*

The participant stands in an open area with arms relaxed at the side, and rotates the trunk from side to side, while allowing the upper extremities to swing gently. The feet should be allowed to pronate and supinate to accommodate for weight shift. The knees can be slightly flexed to reduce strain to the joints of the lower extremity. This exercise should be performed in a relaxed manner, while controlling momentum. Good standing posture should be maintained throughout this exercise, and therefore it may be best to begin with small ranges.

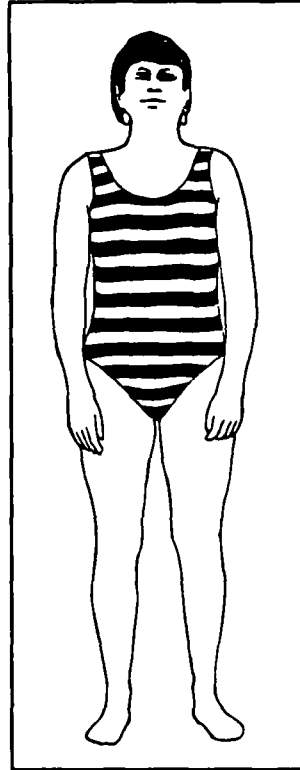
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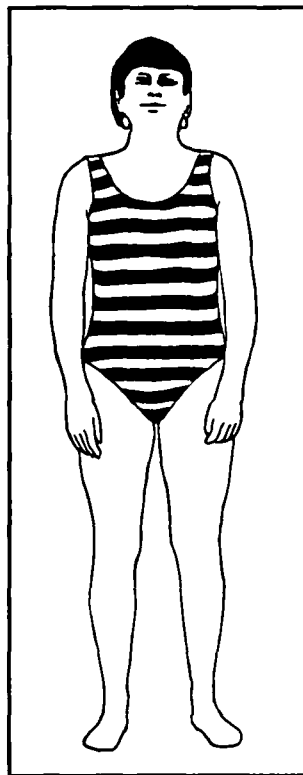
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**ISOLATED LOWER TRUNK ROTATION:**

**PURPOSE:** *Rotation of the lower trunk and pelvis relative to a stable upper trunk*

The participant holds onto a chair positioned directly in front of him/her to stabilize the upper body, and then rotates the pelvis to the right and left while keeping the shoulders and upper torso pointing straight ahead. The feet should pronate and supinate in synchrony with the motion, but the feet should not be lifted off the floor.

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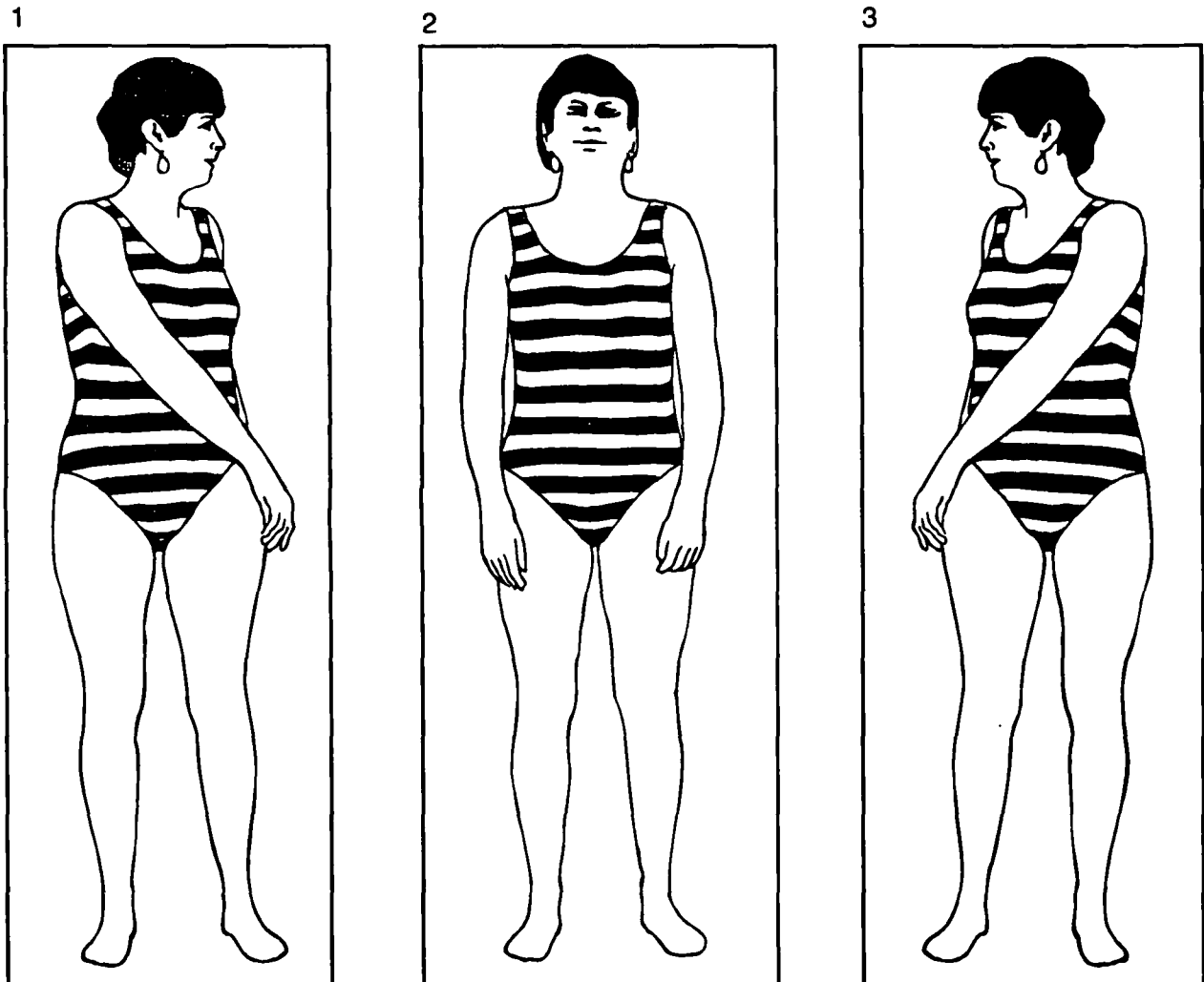
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### ISOLATED UPPER TRUNK ROTATION:

**PURPOSE:** *Rotation of the upper trunk relative to a fixed pelvis and lower extremities*

The participant stands and rotates the cervical and thoracic regions to the right and left, while allowing the upper extremities to follow the motion. The pelvis and lower extremities should remain stationary, with the pelvis facing forward.



### STANDING PELVIC CLOCK:

**PURPOSE:** *Isolated pelvic movement in all planes in standing*

The participant stands and moves the pelvis from an

anterior tilt, to a lateral tilt, a posterior tilt, and then a lateral tilt to the opposite side. The movement is repeated several times in a smooth and continuous fashion. The participant then repeats the motion in the other direction. The participant should maintain good alignment, and avoid lateral or forward bending. The knees may flex and extend slightly.

**LATERAL PELVIC TILT IN STANDING:**

**PURPOSE:** *To initiate lateral weight shift at the pelvis*

The participant stands with hands resting on the back of a chair. S/he then shifts weight from the right to the left hip, allowing the pelvis to laterally tilt. The knees should flex and extend as the pelvis tilts side to side.

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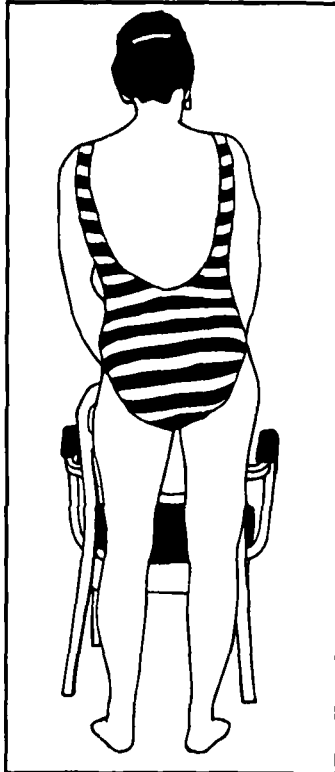
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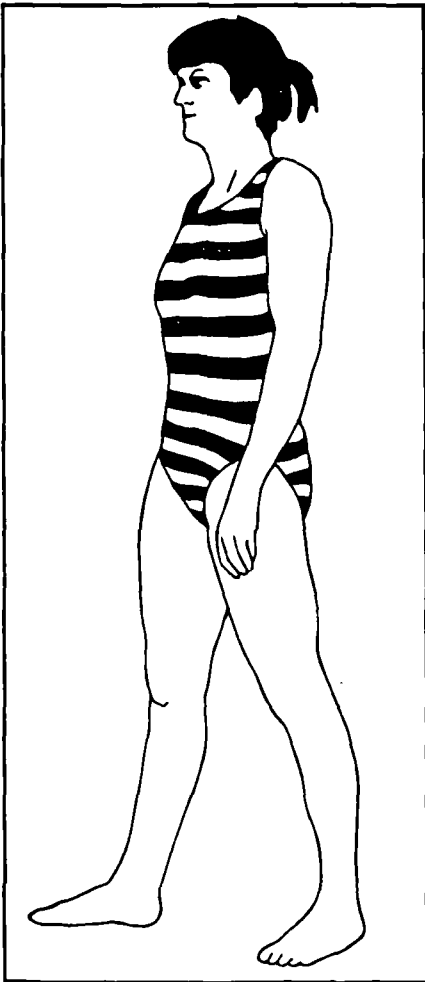
## FORWARD AND BACKWARD WEIGHT SHIFTS:

**PURPOSE:** *To use the pelvis to initiate and control weight shift in functional planes*

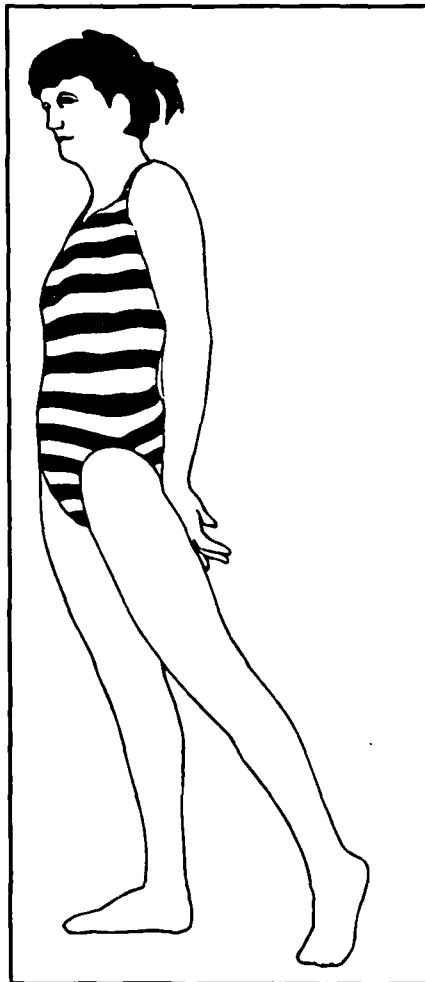
The participant stands with one foot in front of the other, as if taking a step. S/he then shifts weight from one extremity to the other, initiating movement from the pelvis. The knees should remain relatively straight. When

the participant's weight is over the front foot, s/he should maintain as ideal an alignment as possible. The participant should not be leaning forward at the hips or trunk. When shifting posteriorly, the participant may flex slightly at the hips to help maintain balance. Also, as weight is shifted anteriorly over the forward foot, the heel of the posterior foot is allowed to rise. As the weight is transferred back to the posterior foot, the toe of the forward foot is allowed to rise. The participant should feel the weight shift from the heel to toe on each foot.

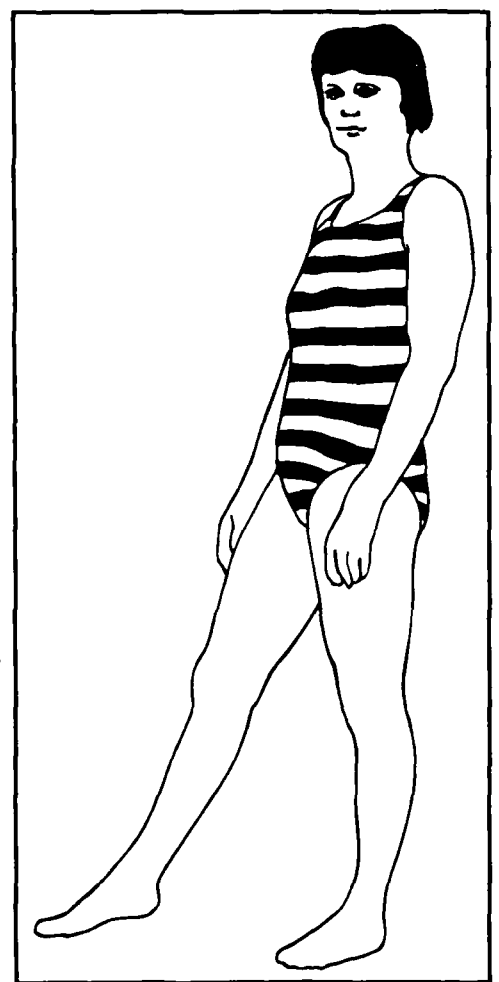
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## DYNAMIC ACTIVITIES:

**PURPOSE:** *To incorporate the segmental movement gained in the previous exercises into dynamic movement*

The participant may do a variety of activities to achieve smooth isolated and coordinated movements during a dynamic activity. The therapist chooses activities which will emphasize components from previous exercises, and which the participant enjoys.

Examples:

Dancing (waltzing, etc.) - to emphasize smooth transfer of weight initiated at the pelvis

Batting a ball - to emphasize total body rotation and isolated upper and lower trunk rotation.

Stepping and walking (forward, backward, sideways) - to emphasize movement initiated at the pelvis and lateral pelvic tilt

Other examples:

Throwing and catching

Kicking a ball

Swinging a golf club or a tennis racket

Figure eights, braiding, turning around .

Fishing (as in casting)

Obstacle course

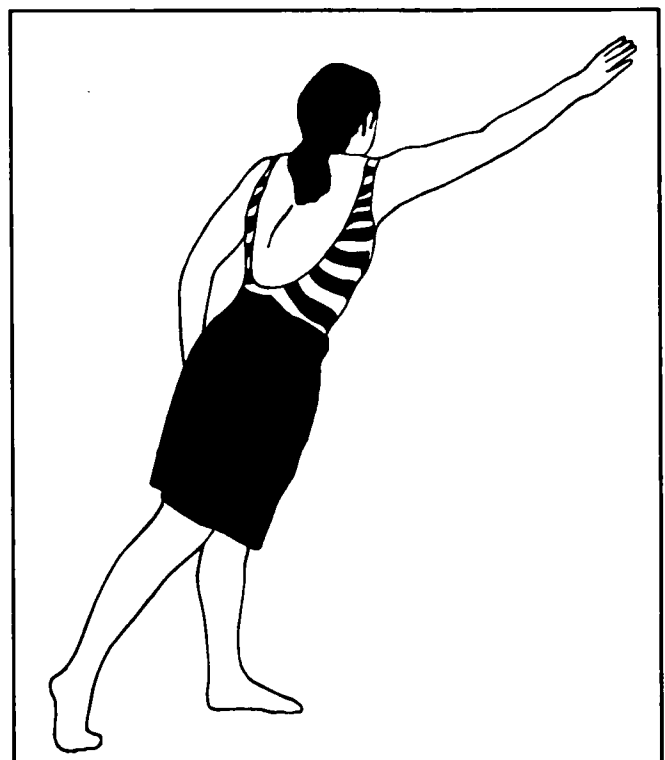
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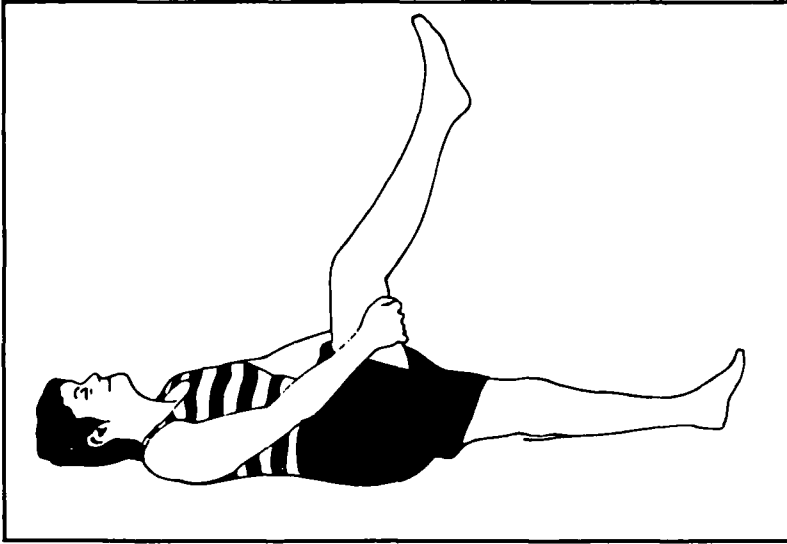




## STRETCHING

The emphasis of this program is on the mobility of the axial skeleton. However, this does not replace the need to perform range of motion exercises for the extremities. Stretching of the hamstrings, and gastrocsoleus complex, for example, should be incorporated into the program as soon as the participant can comfortably

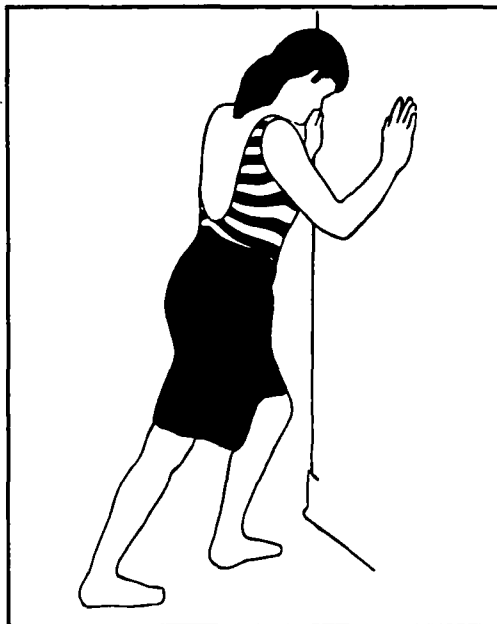
assume the desired position for each stretch. Relaxation and deep breathing are as important during these stretching exercises as they are during the axial exercises. It is recommended to hold each stretch twenty to thirty seconds and to repeat each exercise two to three times.



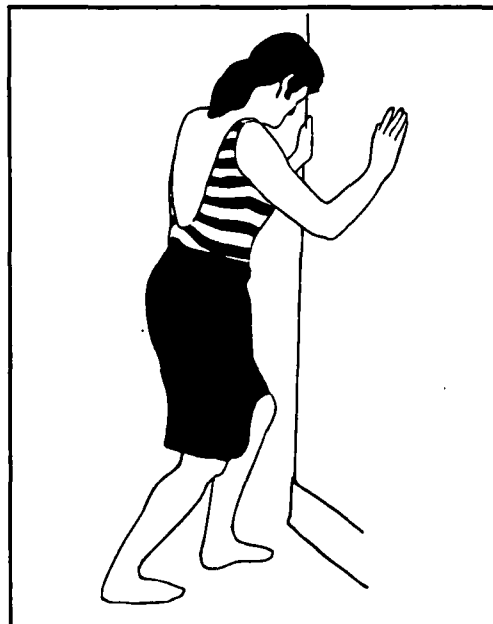
Hamstrings



Hamstrings



Gastrocnemius



Soleus