AXIAL MOBILITY EXERCISE PROGRAM

AN EXERCISE PROGRAM TO IMPROVE FUNCTIONAL ABILITY

THERAPIST'S MANUAL

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Physical Therapy Program
University of Colorado at Denver and Health Sciences Center
Denver, CO

Third Edition

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PREFACE TO THE THIRD EDITION

This exercise program is designed for older adults with a variety of musculoskeletal and neurological disorders. It acknowledges the following principles that distinguish it from other approaches to exercise and functional training:

- Loss of mobility of axial structures has a profound impact on posture and function.
- Posture can be improved and movement made easier, smoother, and more efficient by enhancing spinal, scapular, and pelvic mobility.
- Range of motion, deep breathing, and relaxation are all related. Relaxation helps to promote the efficient use of muscles and to increase range of motion, and deep breathing helps to facilitate relaxation.
- Participants learn to incorporate new movement patterns into daily functional activities.

This manual is designed to help physical therapists teach the exercise program. The therapist and participant work through the program stages together, practicing and refining movements. The therapist decides which exercises are most important for the participant, and assigns them in a companion participant manual that presents the same exercises, but with more descriptive titles and in a format designed for home use.[1] The participant should be independent in an individualized set of exercises, including the practice of functional activities. The exercises and movement patterns learned should become an integral part of each participant's daily life.

Through extensive use of this program over the past decade, we have identified several additional exercises that should be included and have modified a few others. We also have revised some of the instructions for ease of application. Both the Participant's and Therapists' manuals have been revised to reflect these changes. In addition, we have developed a companion exercise program that is designed to assist participants to incorporate axial mobility and improved movement organization for balance control and daily functional activities. This companion program is outlined in an therapist's manual.[2] For more information, or to obtain the therapist's manual, call 1-303-724-1266.

Since publication of the First Edition of this manual, a number of studies have been published, identifying the role of spinal motion for specific functional activities and balance control. An intervention study has been published, demonstrating improved reach distance (a measure of balance control) for individuals who participate in exercise to improve spinal mobility. We have used this program to assist frail older individuals, individuals with chronic progressive disorders such as Parkinson's disease, and individuals with musculoskeletal complaints such as chronic or recurrent back pain. It is our hope that this exercise program will continue to be of use to other professionals in the treatment of individuals with a variety of underlying disorders.

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AXIAL MOBILITY AND PHYSICAL PERFORMANCE

One focus of physical therapy is to help patients improve performance of daily functional tasks. 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. Physical impairments, such as loss of range of motion, strength, and cardiovascular fitness, have been correlated with declining functional mobility and can be improved through appropriate exercise.[1-4] The decline in physical function commonly found in elderly individuals is better explained by the cumulative effects of a number of small impairments than by one specific impairment[5,6]. Lessening the cumulative burden of deficits can promote functional gain. The role of the physical therapist is to recognize modifiable factors and to direct treatment appropriately.

Spinal range of motion is one potentially modifiable factor that can influence physical performance and function.[7-10] Several investigators have demonstrated associations between spinal flexibility and physical performance [2,3,7,8] and with balance.[7,9,10] In a comparison of people with and without Parkinson's disease, the association between spinal flexibility and balance (measured by reach distance) was independent of disease state.[7] Exercises have been demonstrated to improve axial mobility and balance of people who have Parkinson's disease.[10]

The role of the spine in functional performance can be appreciated by observational analysis of 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 appear to be very energy consuming.

The sit to stand transfer is another example of a movement that is more efficient with adequate spinal motion. To perform this task, it is necessary to move the body center of mass from the original base of support (under the buttocks) to the new base of support (the feet). This can be accomplished in a variety of ways. One way is to anteriorly tilt the pelvis, positioning the center of mass closer to the feet. 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. Using this strategy, the individual may need to generate momentum by rocking the trunk forward. If the body center of mass fails to move far enough toward the feet, the individual falls back into the chair seat.

A final example is the ability to turn and see behind oneself, which is most effectively accomplished by rotating 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. In sitting, the person with restricted spinal mobility may be particularly limited when attempting to look posteriorly because the pelvis and lower extremities are more fixed in sitting. Older people often report difficulty while driving when turning to look behind themselves (e.g., when backing up a car).

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, an individual who lacks lumbo-pelvic movement may demonstrate inadequate lateral 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 disorders, such as Parkinson's disease, as well as aging itself.[7,11-16] Many authors have described reductions in spinal flexion, extension and lateral flexion of up to 50% in individuals from the third to eighth decades.[11-16]

Few exercise programs systematically address the motion of the axial structures and incorporate it into daily activities, although exercise to improve axial mobility can improve physical performance and balance.[10].

The Axial Mobility Exercise Program provides a comprehensive set of exercises that address motion in all planes and for all regions of the spine, shoulders, and pelvic complexes. From a kinesiologic perspective, emphasis is placed on the mobility of these regions in a functional context. Both segmental and coordinated movements are practiced, with special consideration 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.

Several recourses are available for the clinician and participant:

1. This edition of the Axial Mobility Exercise Program – Therapist's Manual includes new exercises as well as revised descriptions of previous exercises.
2. The companion Axial Mobility Exercise Program Participant's Manual also has been updated and revised. The Participant's manual presents the exercises in a format designed for home use.[17] The exercises are the same in both manuals, with several of the names changed in the participant's manual to facilitate comprehension.
3. Two videotapes also are available, one for the therapist and one for the patient[18,19] The videotapes and manuals are designed to assist therapists to teach the exercises and patients to learn the program. The goal is for the patient to continue the exercises at home after learning the program under the direction of a physical therapist.
4. In addition, a companion exercise program now is available[20] to help participants incorporate increased spinal range of motion and improved movement patterns into daily activities. This manual is designed for therapists.

These manuals and videos are available for purchase at cost by calling 303-724-1266.

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Introduction To The Exercise Program

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

The exercises are designed to:

- Enhance participation of appropriate synergistic muscles without increasing strength or mobility beyond normal levels. This will decrease participation of overactive muscles, and increase participation of muscles that are not active enough.

- Increase range of motion and ability to coordinate movement through exercises that emphasize relaxation facilitated by breathing, as opposed to effort.

    - o Prior to initiating exercises, the participant should use gentle diaphragmatic breathing to promote relaxation of musculature throughout the body.

    - o Relax muscle groups and increase range of motion through deep breathing initiated at the point in the range of motion when they first become tight.

- Recognize that axial structures form the base from which extremity and whole body motions occur.

    - o Exercises are organized so that relaxation and mobility of axial segments always precede mobility of limb segments. This proximal to distal progression ensures optimum participation of all body segments during functional movement.

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

- Become increasingly complex as the participant becomes proficient. Complexity is achieved by:

    - o 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).

    - o Decreasing the support surface (e.g. progressing from supine to sitting to standing), which increases demands for balance control and necessitates that more body segments participate in the desired movement.

- Build on exercises learned in previous stages.
    - o Always begin with exercises introduced in the early stages in order to enhance relaxation and to retain optimal range of motion.
    - o 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.
    - o The therapist may emphasize specific exercises according to the participant's individual needs.

- Enable the participant to independently follow the exercises and remain compliant.

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

- Enable the participant to use improved mobility and postural alignment for enhanced balance and functional ability.
    - o Functional mobility training and the home program are integral components of the exercise program.
    - o Functional mobility training helps the participant learn to incorporate isolated coordinated movement into rele-

vant functional activities of daily life. The therapist should incorporate a wide variety of activities, appropriate to the participant's interests and needs for daily function. You will find some examples in this manual.

- o A companion exercise program is available that focuses on incorporating axial mobility into balance and function.

To achieve this exercise program's goals, the therapist and participant should:

1. Perform exercises slowly, in a relaxed and precise manner.

Participants should be conscious of achieving desired movements with minimal effort. The effort used should be just enough to perform the movement, minimizing substitution by accessory muscles. 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. It can also 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 encourage relaxation. The therapist will modify the positioning as needed 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 therapist should use manual techniques when teaching the exercises, and then reduces and eliminates these as the participant becomes proficient. Manual techniques include:

    - Light touch to indicate direction and reversal of movement.
    - Pressure over a muscle group (e.g., the pectoralis muscles) to indicate the need to relax these muscles.
    - Tapping over a muscle group (e.g., the abdominus obligues) to indicate that the participant should contract these muscles.
    - Movement of a body segment (e.g., pelvis through anterior/posterior displacements) to demonstrate and then facilitate the desired movement.

3. The therapist should modify exercises based on the participant's orthopedic, muscular, or medical impairments. While these exercises can benefit almost everyone, 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
    - Lower back pain
    - Other painful conditions of the spine and extremities
    - Severe cardiovascular disease

    Modifications include, but are not limited to:

    - Restricting movement to a pain free range of motion.
    - Altering positions to minimize pain (e.g. Use pillows for positioning).

- Avoiding positions and movements that could cause fracture in an osteoporetic participant (e.g. Consult with attending physician as necessary).
- Monitoring cardiovascular status in positions and during activities that could unduly stress the cardiovascular system (e.g. Quadruped, prone, sit to stand).
- Deleting inappropriate exercises (e.g., quadruped for people who have severe thoracic kyphosis; exercise provokes pain despite attempts to modify positions).

4. The therapist should modify 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.

5. Each participant should follow an individual, daily *home exercise program* as specified by the therapist. 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 remediating the participant's specific impairments. 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. S/he then begins to increase range of motion for each exercise. Isolation of movement is more important than the amount or range of motion.

GOALS:

- Improve chest expansion during breathing.
- Relax trunk, hip, shoulder, and neck regions.
- Increase range of motion while retaining relaxation.
- Retain the relaxation of antagonist and accessory muscles while moving.

FUNCTIONAL RELEVANCE:

- Help prevent pneumonia.
- Preparatory for functions such as bed mobility and walking.

POSITION:

The participant lies supine with pillows, towel rolls, and bolsters under head, neck, and knees as needed to achieve maximal relaxation and optimal alignment within the available range of motion. External support may decrease as the participant's posture and alignment improves.

SPECIFIC EXERCISES:

The participant should be able to perform the following exercises independently while remaining relaxed. Deep breathing during and at the end of a motion should be incorporated during all stages. The suggested order of exercises is based on a kinesiological analysis of functional movement as well as clinical experience. It is as follows:

- Deep breathing
- Trunk
- Hip
- Full leg rotation
- Shoulder
- Neck
- Coordinated neck, shoulder, hip or trunk motion
- Rotation of the entire upper extremity
- Elbow, wrist and hand rotation

Some participants, depending on issues such as areas of greatest restrictions or movement preference, may benefit from a change in order. For example, some participants respond best when shoulder rotation precedes trunk rotation.

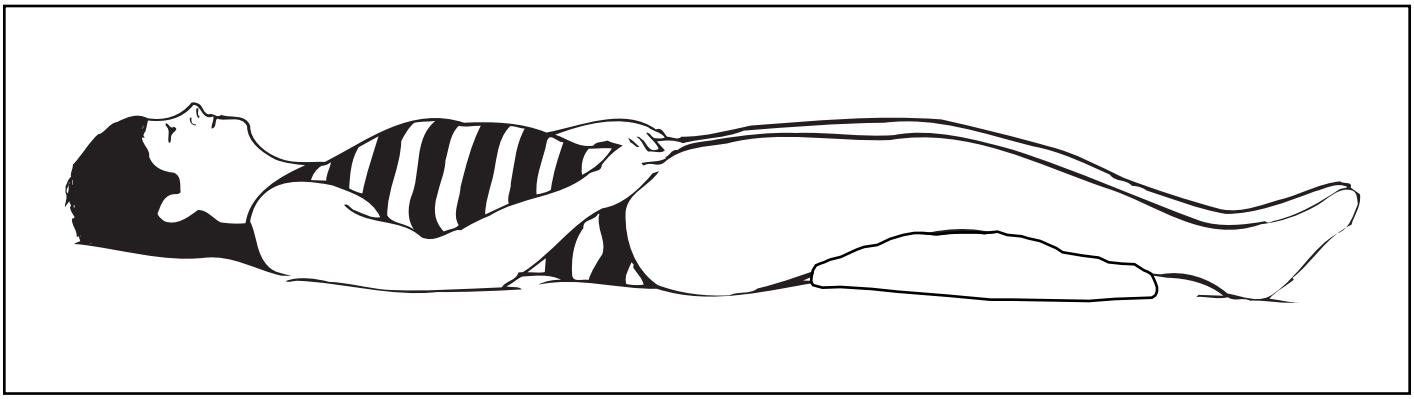
CRITERIA FOR PROGRESSION

- 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.

I-1 DEEP BREATHING

PURPOSE: Learn how to use breathing to promote relaxation, and improve mobility of the ribs for increased thoracic expansion.

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



I-2 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 of soft tissue. The motion should be gentle to achieve relaxation of the axial structures, and the therapist should be able to feel a reduction in the participant's total body tension. The lower back should not lift from the mat more than a few inches. The participant should not attempt to hold the two legs together as this will increase muscle tension throughout the torso; the adductor muscles should be relaxed. The therapist can provide light tactile cues on the lateral border of the each knee in the direction of movement in order to facilitate relaxation.

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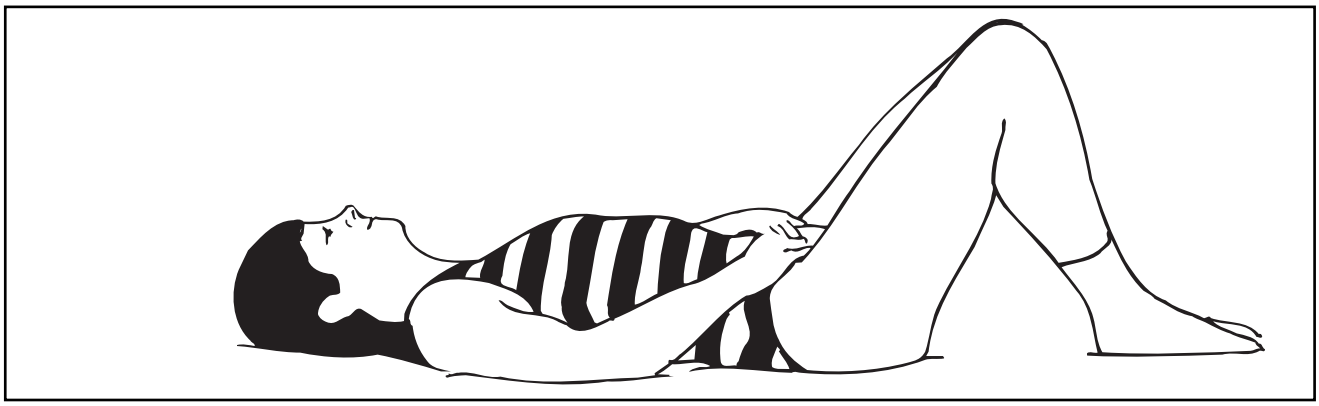

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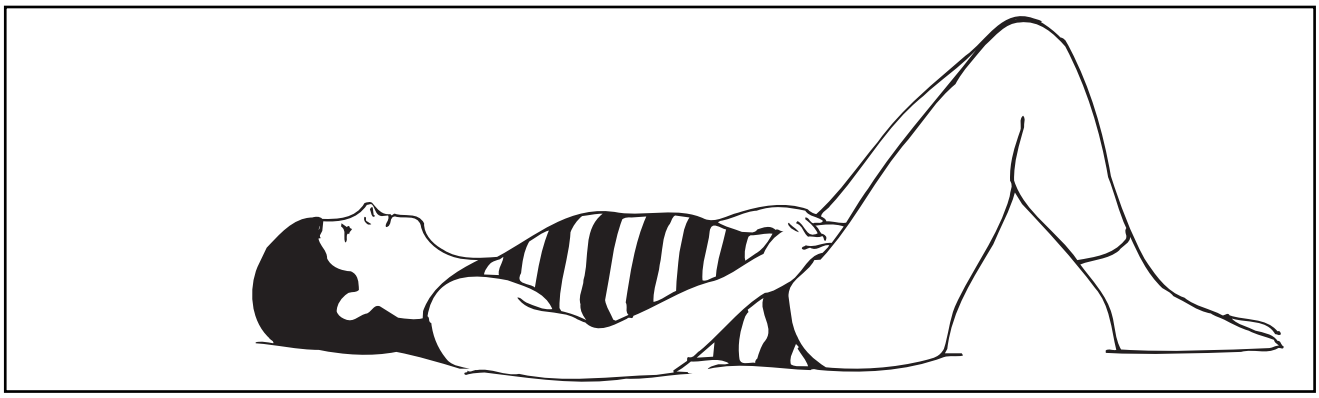

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I-3 HIP

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 one knee from side to side to achieve hip ab/adduction without pelvic motion. The motion should be repeated slowly and rhythmically until the leg moves smoothly through the range. (Note that full range is not necessary; relaxed movement is desired.)

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.

After each leg is relaxed and moving freely, the activity can be performed bilaterally with both legs abducting, and then both adducting.

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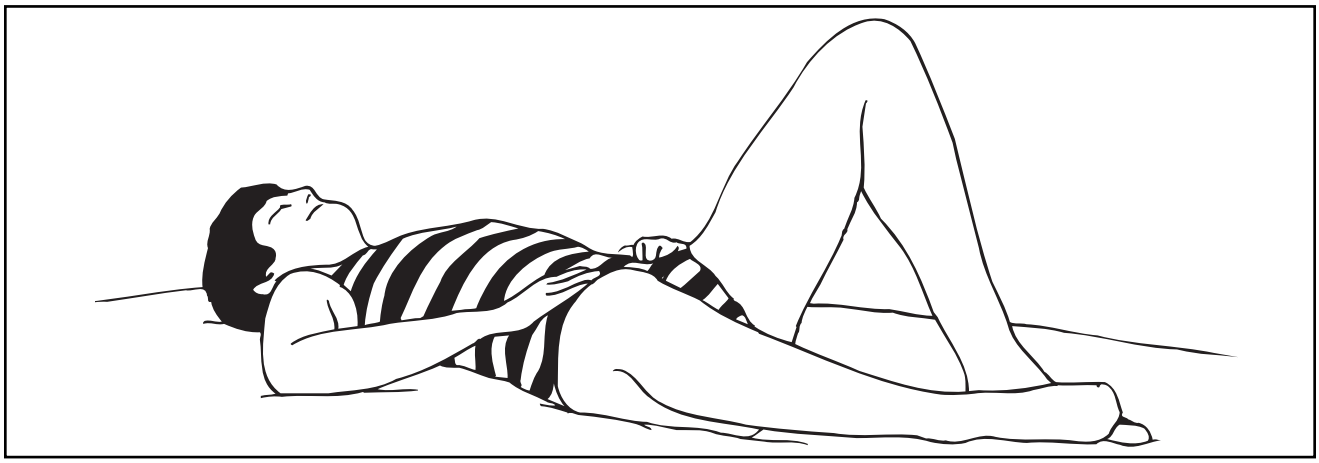

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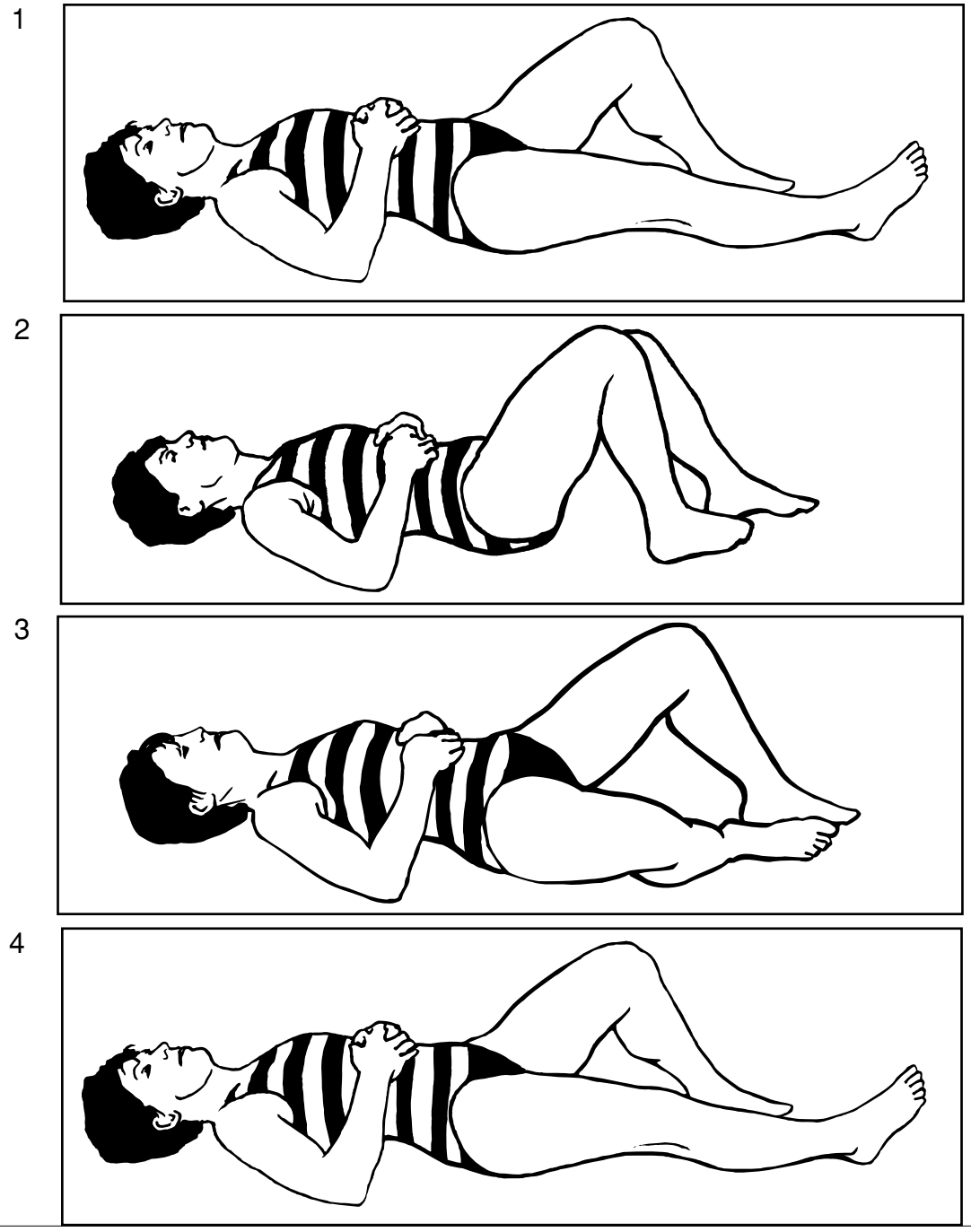
I-4 FULL LEG ROTATION

PURPOSE: To develop smooth, coordinated movement of the entire lower extremity as a unit.

This exercise is particularly important for individuals experiencing rigidity, problems with motor planning, and other impairments that result in a stiff lower extremity. Starting with legs extended, the participant, rolls one leg inward by flexing the hip and knee while simultaneously adducting the hip, and then rolls the leg outward by extending the hip and knee while simultaneously abducting the hip. The foot should circumscribe a small circle during this motion. After repeating the movement a few times, the participant reverses direction (flexion with abduction, followed by extension with adduction) and repeats the entire sequence with the opposite extremity.



I-5 SHOULDER

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

The participant abducts one arm to as close to 90 degrees as possible, keeping the 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 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.

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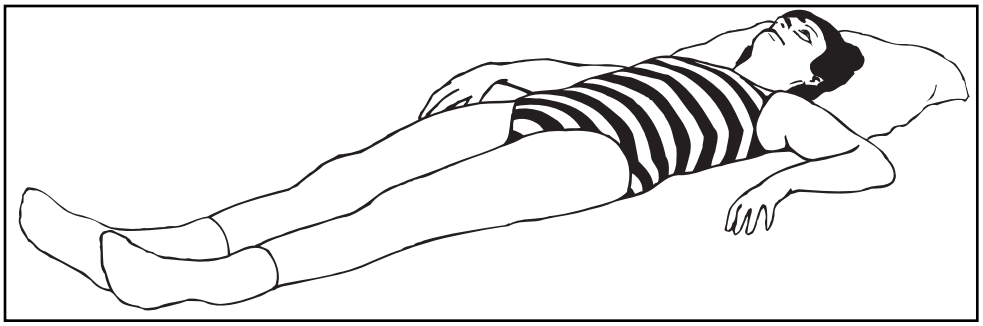

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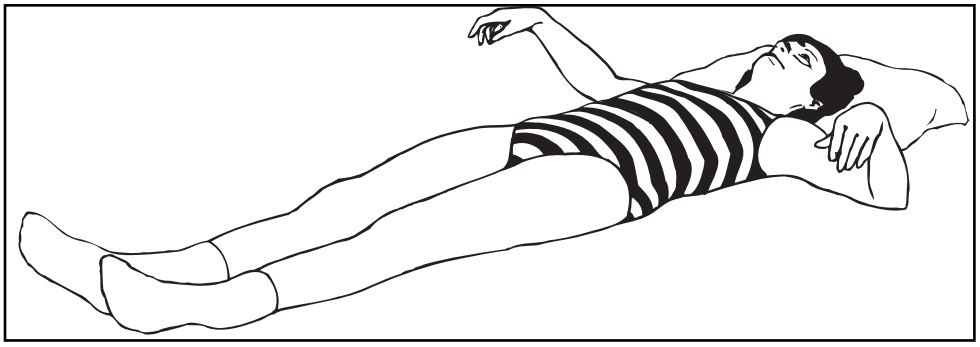

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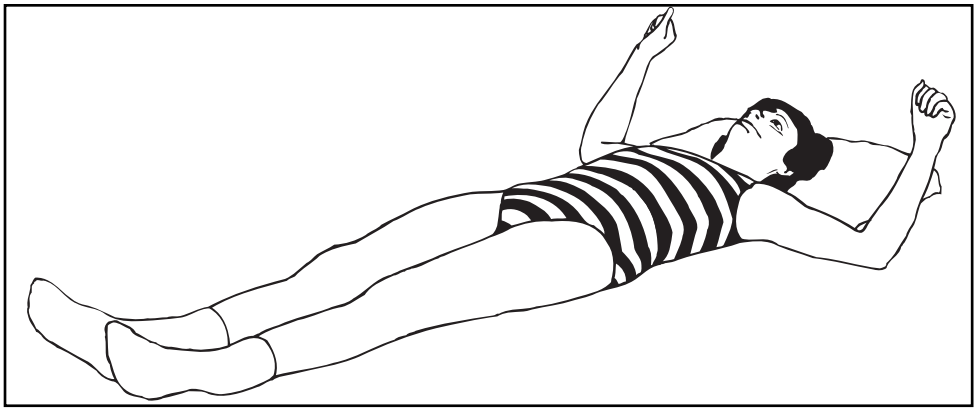

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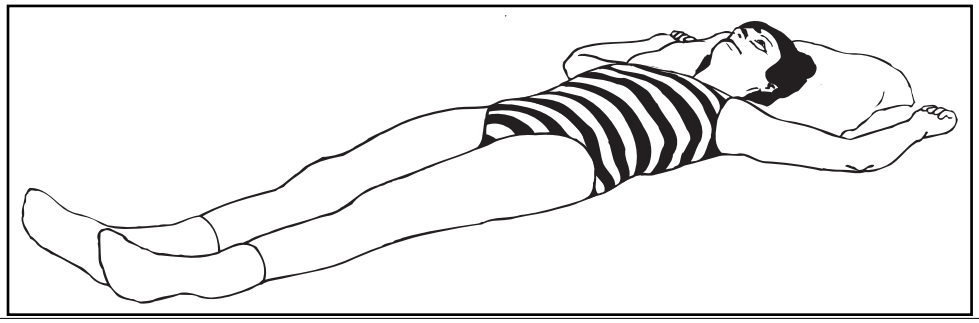

As the participant develops the ability to increase movement while retaining relaxation, s/he may begin to move both upper extremities simultaneously (same direction and then opposite directions). Movement of the upper extremities in opposite directions can be particularly relaxing and can further facilitate spinal extension.

I-6 NECK

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

The participant works to achieve a 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.

If the participant's deep cervical muscles are shortened, participant should use active stretching of soft tissue prior to beginning this exercise. (See page 62, Stretching Exercises)

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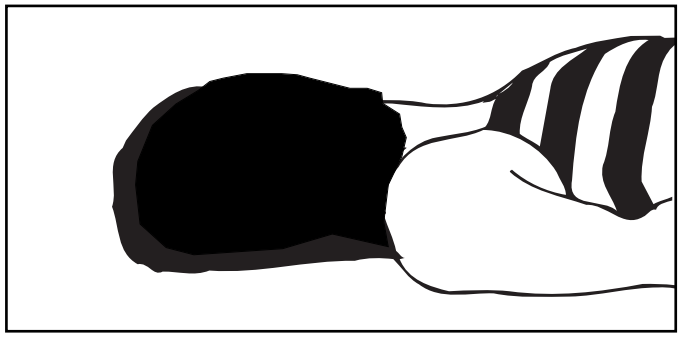

I-7 COORDINATED NECK, SHOULDER, HIP OR TRUNK MOTION

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 (e.g. cervical rotation with symmetrical or asymmetrical glenohumeral rotation; and with lower trunk or hip rotation in the opposite direction).

Note that the complicated movement sequence requires motor planning ability. The therapist should observe carefully and omit this exercise if it results in increased muscle tension either of a specific extremity or throughout the body.

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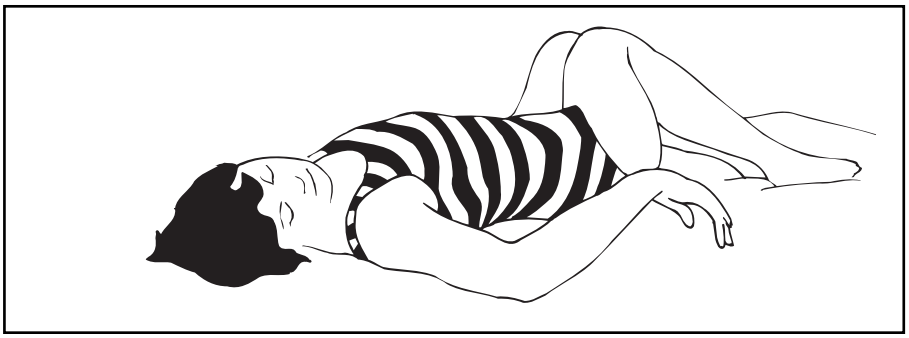

I-8 ROTATION OF THE ENTIRE UPPER EXTREMITY

PURPOSE: Improve range of motion throughout the upper limb and develop smooth, coordinated movement of the upper extremity.

This exercise is particularly important for individuals with rigidity, problems with motor planning, and other impairments that result in a stiff upper extremity. Starting with the elbow and wrist extended and the shoulder slightly abducted, the participant flexes the elbow while internally rotating the shoulder and pronating the forearm, bringing the hand over the abdomen, then up toward the face. The participant then externally rotates the shoulder, while extending the elbow and supinating the forearm, and finishes by returning the forearm to neutral. This sequence should be performed as a smooth, continuous motion. After repeating the movement a few times, the participant reverses direction (flexion with external rotation and supination, followed by extension with internal rotation and pronation, ending with supination of the forearm to neutral). The participant then repeats the entire sequence with the opposite extremity.

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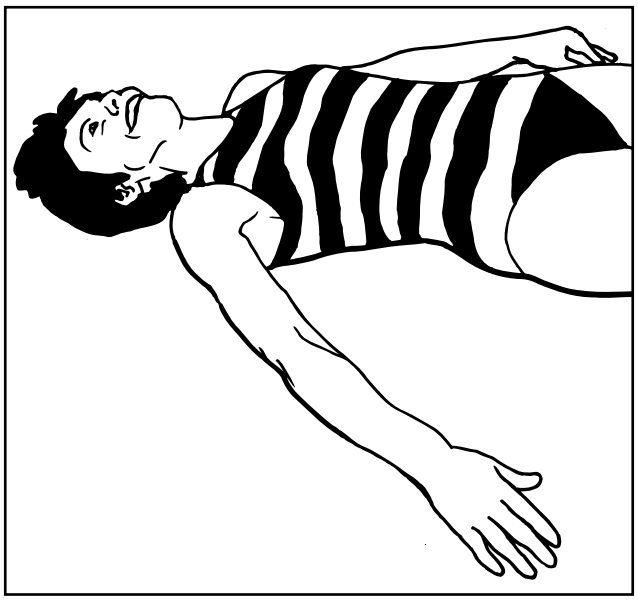

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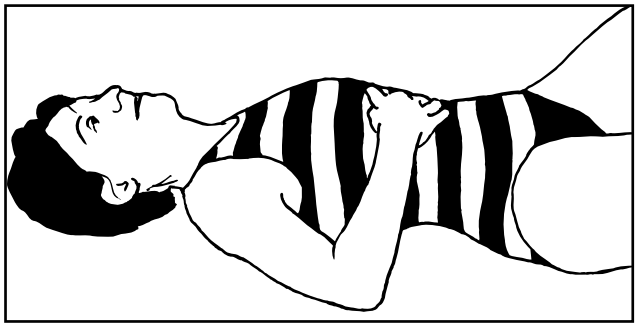

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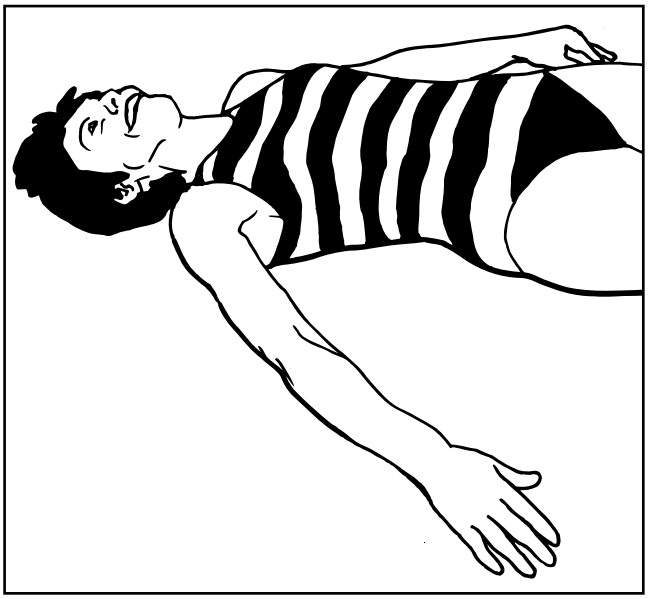

I-9 ELBOW, WRIST, AND HAND ROTATION

PURPOSE: Improve range of motion of the hand and wrist; reduce 'tenting of the hand' (as occurs in Parkinson's disease).

Starting with elbow and wrist extended and the shoulder slightly abducted, the participant gently and smoothly flexes and extends the elbow in a rhythmical fashion several times. The participant then gently and smoothly moves the wrist back and forth in a rhythmical fashion through ulnar and radial deviation.

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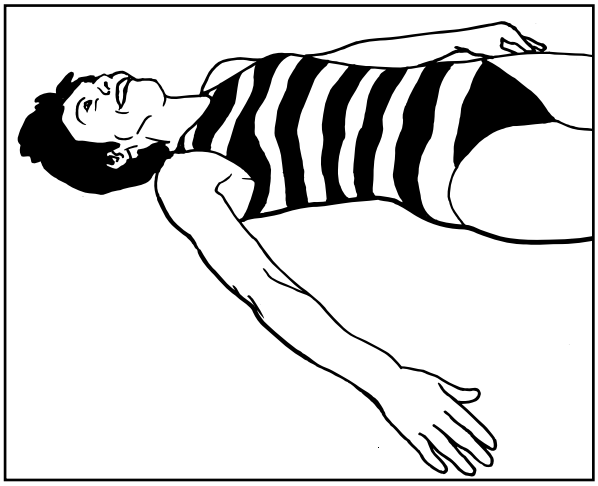

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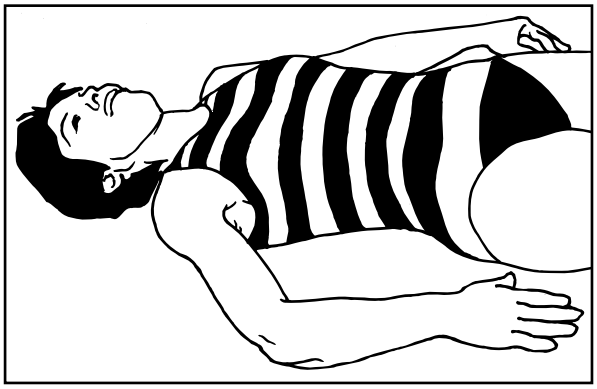

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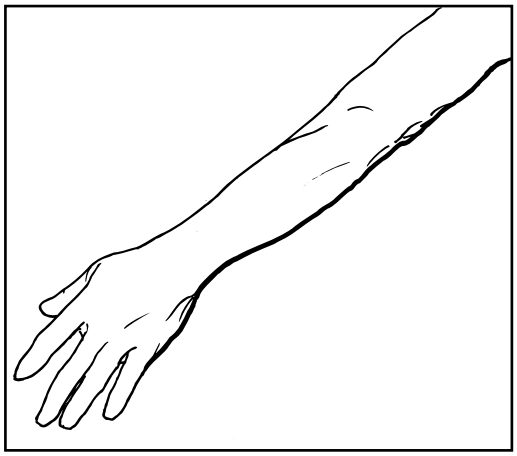

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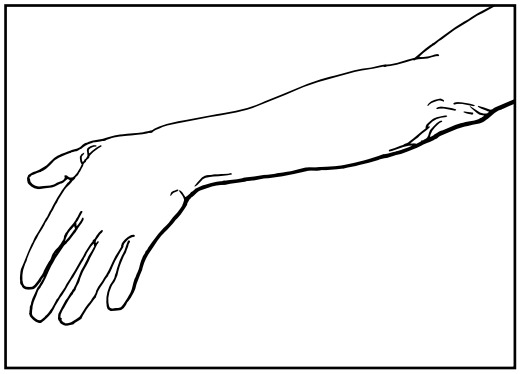

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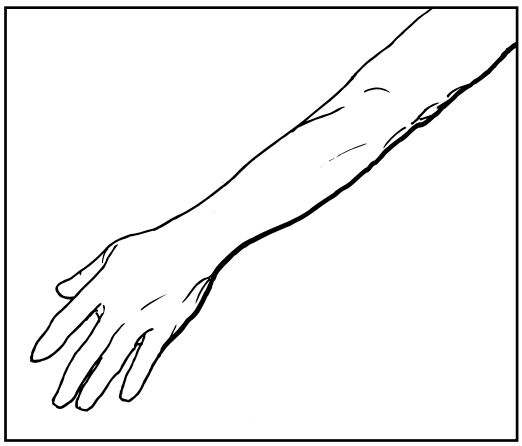

STAGE II: SEGMENTAL MOTION OF THE SPINE AND UPPER QUADRANT, WITH EMPHASIS ON THE THORAX (WEEK 2)

The participant learns to:

- Isolate thoracic and scapular movement on a stable thorax.
- Coordinate movement of the glenohumeral, scapular, and thoracic regions on the fixed pelvis. Emphasis is on isolation as opposed to quantity of movement.

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

FUNCTIONAL RELEVANCE:

- Mobility in bed.
- Reaching for items while in bed (e.g., lamp, alarm clock, book).
- Preparatory for turning while sitting (e.g., look behind while driving).

POSITION:

The participant lies on his/her side with a neutral spine and with hips flexed almost to 90 degrees to stabilize the pelvis and to allow rotation of the thorax relative to the pelvis. The therapist may provide further stabilization using downward pressure over the thigh until participant learns to move the thorax while the pelvis remains relatively stable.

SPECIFIC EXERCISES:

- Scapula and thorax on a stable pelvis.
- Scapula on the thorax.
- Thorax on the stable pelvis.

FUNCTIONAL MOBILITY TRAINING:

Stage II exercises prepare the participant for critical functional activities related to mobility in bed. The therapist guides the participant to practice reaching in different planes in side lying. 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. Ideally, s/he also practices with an actual bedside lamp, alarm clock, or related item.

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

For participants who have difficulty managing covers (e.g., sheets, blankets) while in bed, the therapist identifies specific cues and movement sequences that allow the participant to turn over in bed while adjusting the covers.

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.

CRITERIA FOR PROGRESSION:

The participant can:

- Coordinate thoracic and upper extremity movement on a stable pelvis.
- Isolate scapular motion on the thorax.
- Isolate thoracic motion on the pelvis.
- Roll segmentally.

II-1 SCAPULA AND THORAX ON A STABLE PELVIS

PURPOSE: To increase thoracic rotation and to coordinate glenohumeral and thoracic motion.

The participant reaches forward and backward with the humerus in the sagittal plane of the body. The motion of the thorax and upper extremity should be smooth and coordinated, with the oblique abdominal muscles contracting during forward motion. The therapist may need to use manual cues over these muscles to help the participant incorporate them. The therapist can use pressure over the abdominus obliquus muscles during rotation of the thorax backwards to facilitate relaxation of those muscles. 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.

Modifications: If the participant has difficulty relaxing the upper extremity, pillows may be used for support. The upper extremity rests on the pillow as the participant moves the arm forward and backward. If the participant is limited by back pain, pillows should be positioned behind to limit backward rotation.

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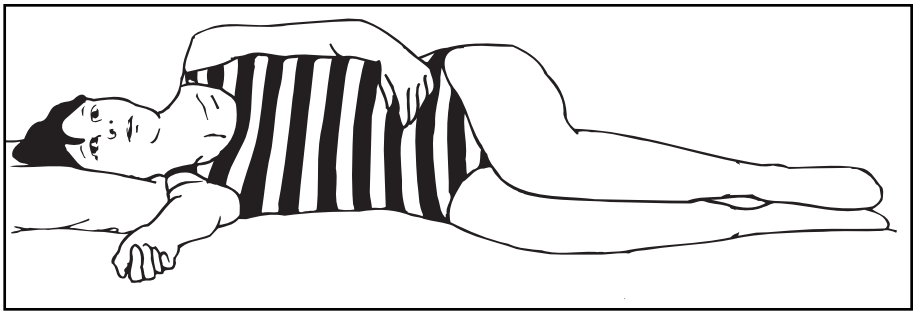

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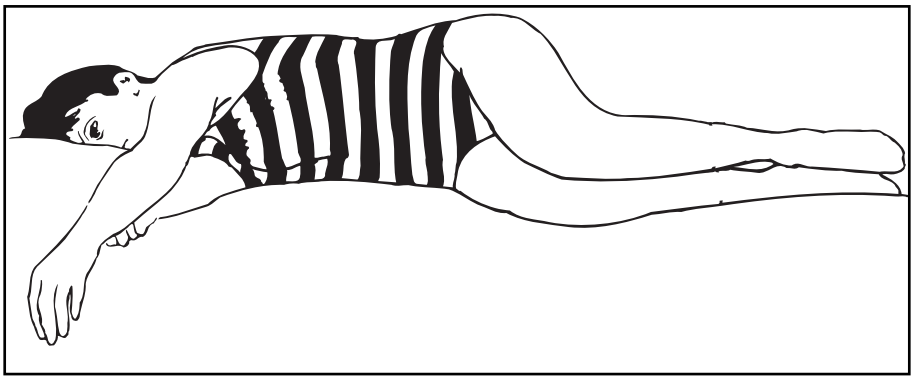

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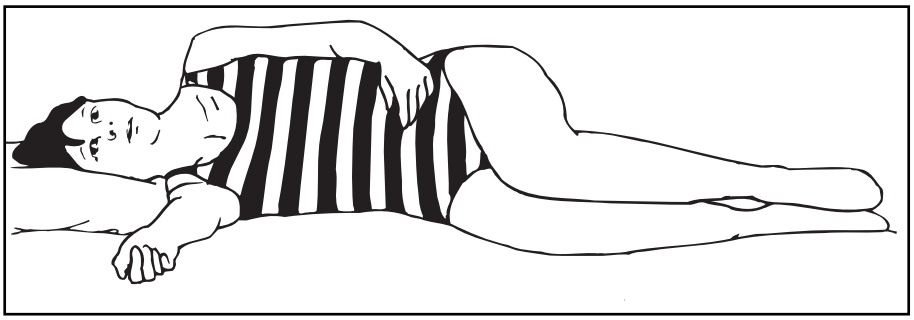

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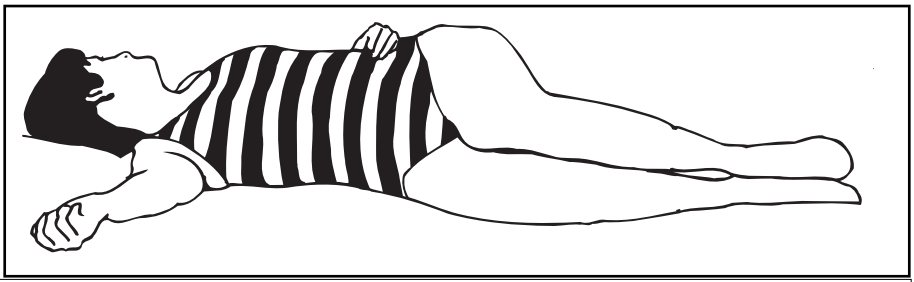

II-2 SCAPULA ON THE THORAX

PURPOSE: To isolate scapular and glenohumeral motion without thoracic motion; and to optimize orientation of the scapula and movement of the scapulothoracic joint.

The participant reaches forward and backward with the arm while maintaining a stable thorax and pelvis. Thoracic movement should be minimized. The scapula should glide smoothly on the thorax. Scapular elevation is avoided. 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.

Modification: If the participant has difficulty relaxing the upper extremity, a pillow may be used for support. The upper extremity rests on the pillow as the participant moves the arm forward and backward.

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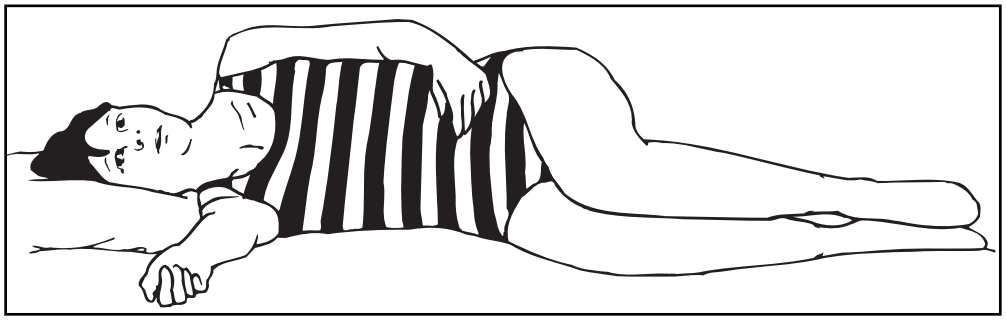

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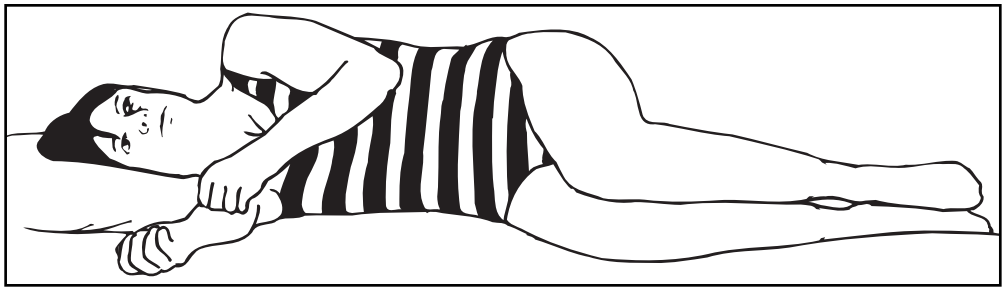

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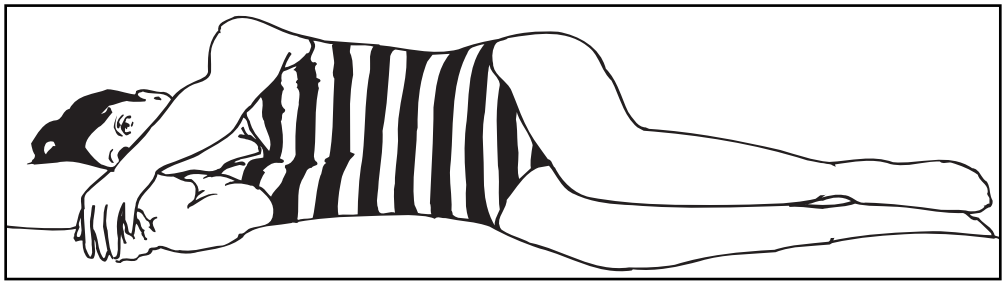

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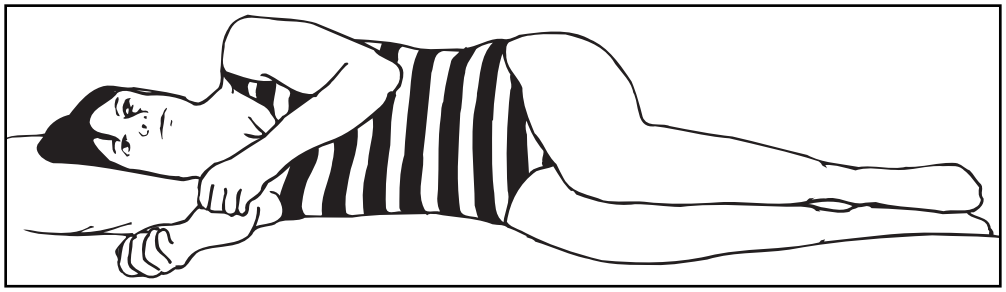

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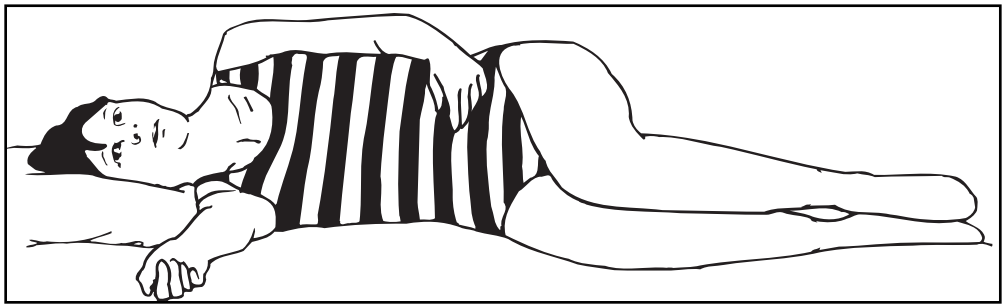

II-3 THORAX ON THE STABLE PELVIS

PURPOSE: To increase thoracic rotation.

The participant practices isolated movement of the thorax on the pelvis, with the upper extremity 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. The therapist may use downward pressure over the thigh to help stabilize the pelvis and may provide manual cues over the oblique abdominal muscles.

This exercise is used only when the therapist determines that it is necessary to isolate thoracic rotation from upper extremity movement in order to enhance range of motion or control of the movement.

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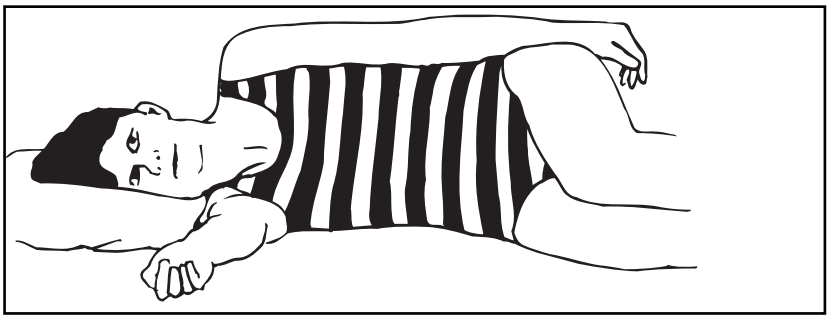

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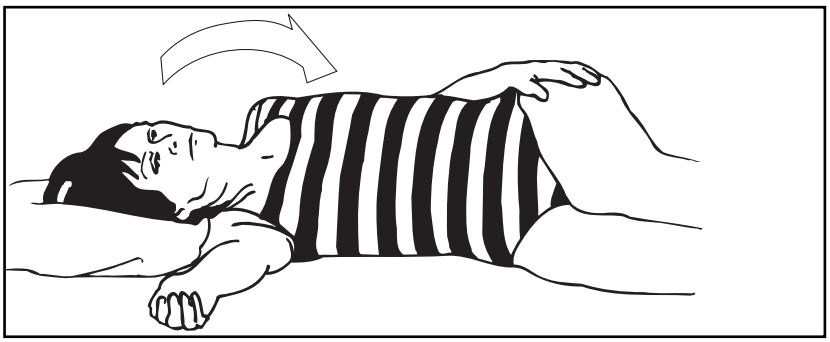

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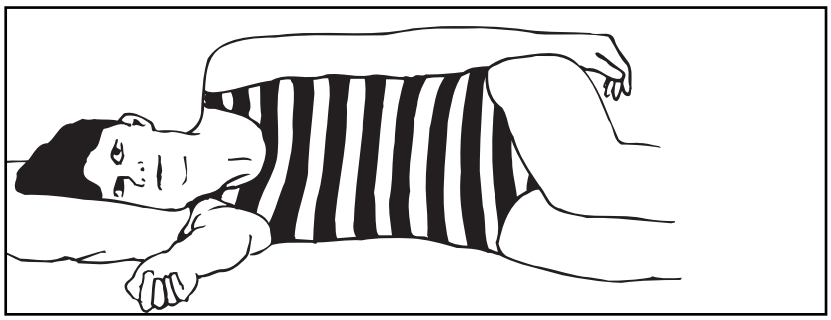

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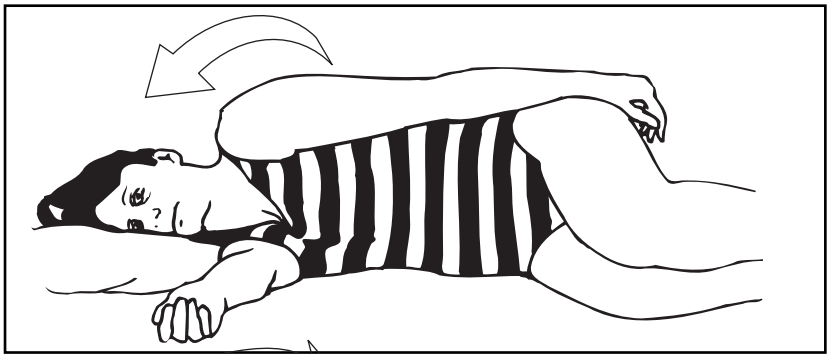


STAGE III: SEGMENTAL MOTION OF THE SPINE AND ISOLATED MOTION OF THE LOWER EXTREMITIES ON A STABLE PELVIS: PRONE (WEEK 3)

This stage introduces the following motions:

- Shoulder and elbow flexion and extension in the prone position
- Flexion/extension of the spine in the prone position.
- Transverse rotation of the low thoracic and lumbar spine on the upper thoracic spine.
- Internal/external rotation of the femur.

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.

FUNCTIONAL RELEVANCE:

- Improved thoracic extension and rib cage movement for improved breathing.
- Improved posture and range of motion for reaching overhead.
- Improved posture and hip rotation, preparatory for balance in standing and for gait.

POSITION:

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

SPECIFIC EXERCISES:

- Shoulder flexion/extension in prone
- Prone on elbows
- Prone pelvic transverse rotation
- Internal/external hip rotation

FUNCTIONAL MOBILITY TRAINING:

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

CRITERIA FOR PROGRESSION:

The participant:

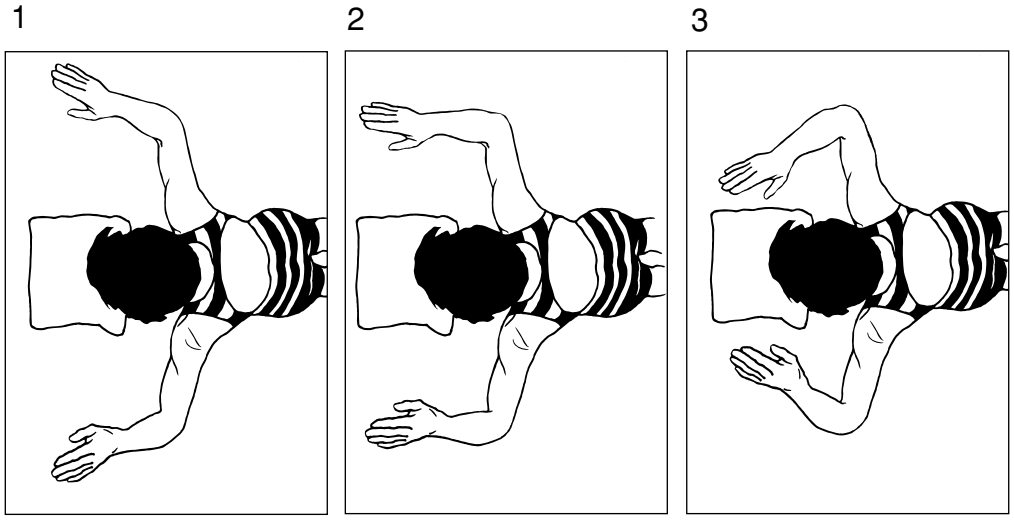
- Is able to independently assume a prone position.
- Demonstrates lumbar and thoracic extension through visible ranges in prone and prone on elbows.

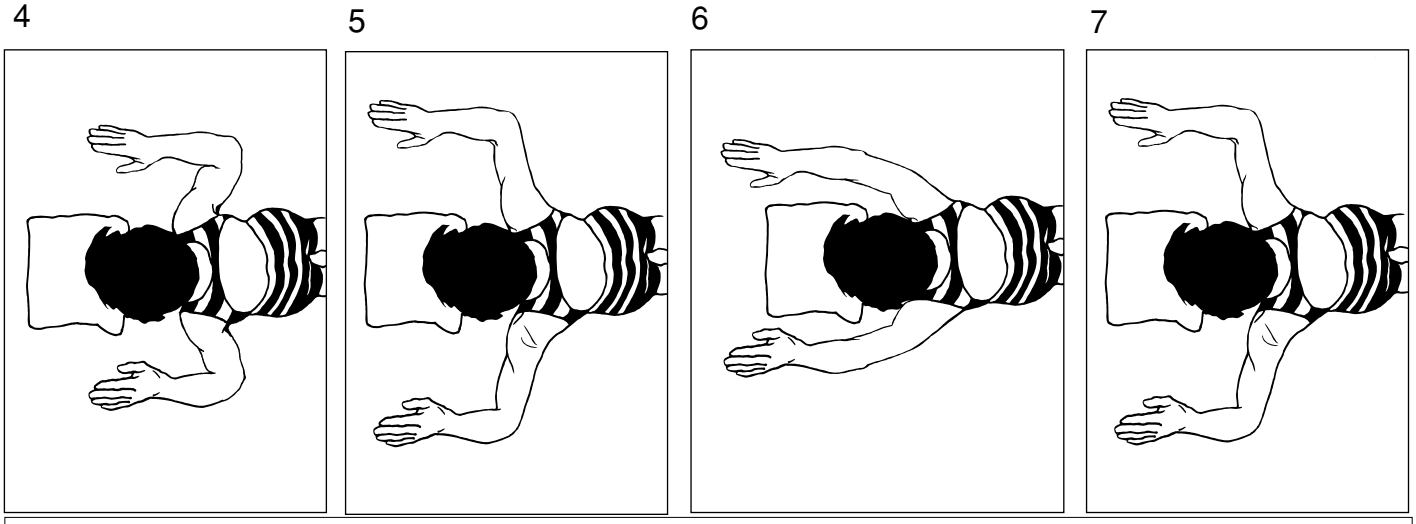
III-1 SHOULDER FLEXION/EXTENSION IN PRONE

PURPOSE: Promote relaxation of the thoracic area; and facilitate relaxed movement of the upper extremity.

The participant abducts and flexes shoulders with 90 degrees of elbow flexion. S/he gently extends one shoulder while flexing the elbow, then flexes the shoulder beyond 90 degrees while extending the elbow. This motion is repeated slowly and rhythmically to promote relaxation. The participant may perform this activity with both extremities simultaneously as long as both arms remain relaxed. To facilitate relaxation of the small muscles in the hands, it is helpful to place a low friction cloth such as a pillow case under each hand.

Modification: The participant abducts and flexes shoulders to 90 degrees with elbows flexed to 90 degrees. S/he gently and rhythmically flexes and extends the elbows without glenohumeral joint motion.





III-2 PRONE ON ELBOWS

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

The participant assumes a position of 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 maintain a relaxed thoracic region in the static position. When necessary, a pillow should be placed under the abdomen (from hips to thorax) to lessen the lumbar extension forces. When this position is tolerated comfortably, the participant 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 downward pressure over the thoracic spine may facilitate extension.

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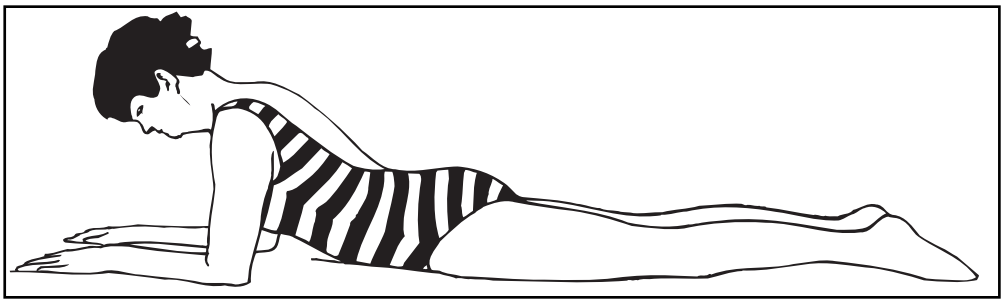

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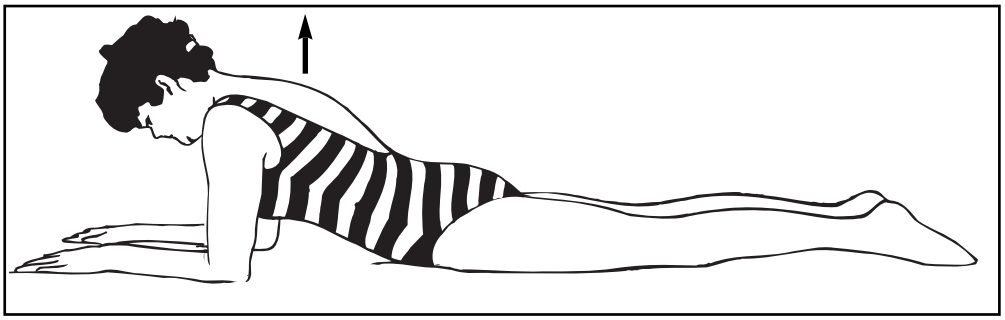

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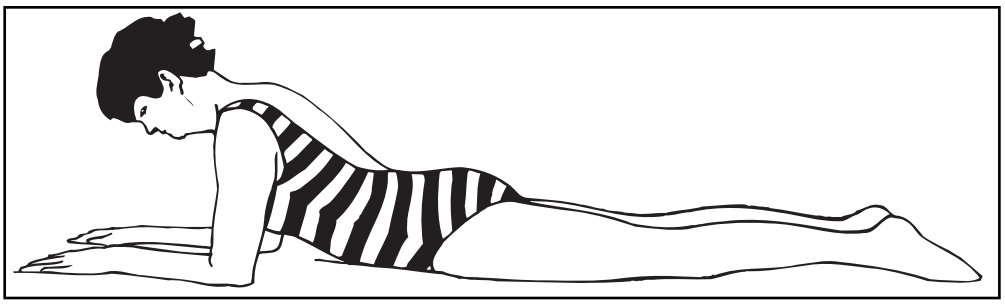

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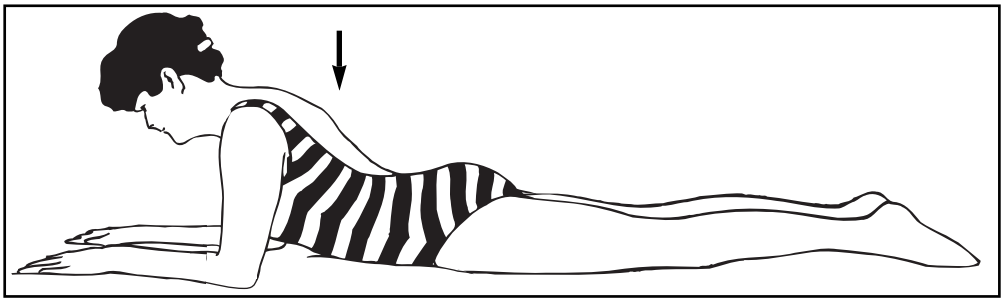

III-3 PRONE PELVIC TRANSVERSE ROTATION

PURPOSE: Promote relaxation of the spine and pelvo-femoral area in preparation for extension exercise; increase lumbar and thoracic transverse rotation from caudal to rostral.

The participant gently rotates the pelvis rhythmically and in a relaxed manner to the right and left (transverse plane) 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.

The instructor may facilitate this motion initially by holding the pelvis by the lateral borders and moving the pelvis through the desired motion. The participant may find that this exercise is easier initially if s/he flexes one or both knees. As proficiency improves, the participant should assume a fully prone position.

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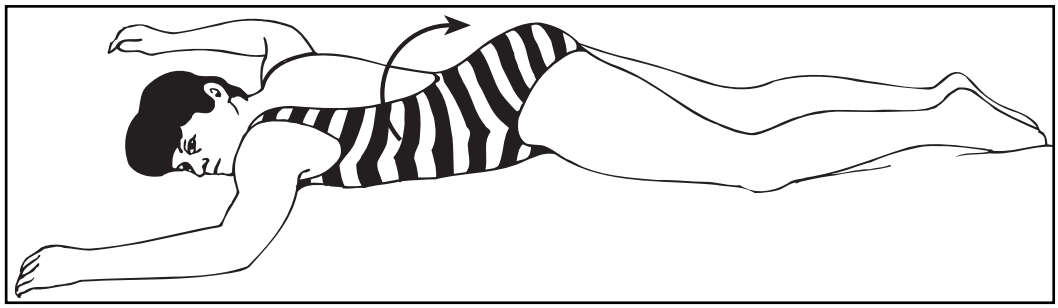

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III-4 INTERNAL/EXTERNAL HIP ROTATION

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 internal and external rotation of the hip is achieved.

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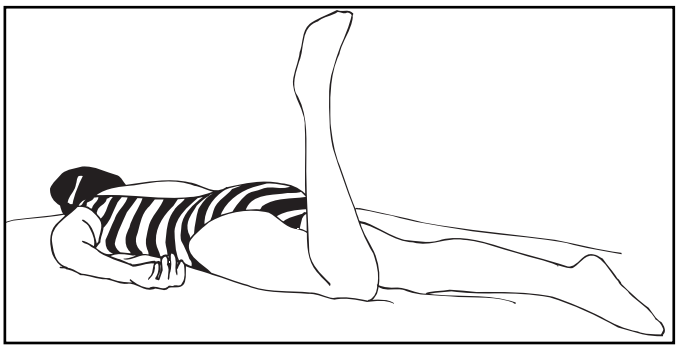

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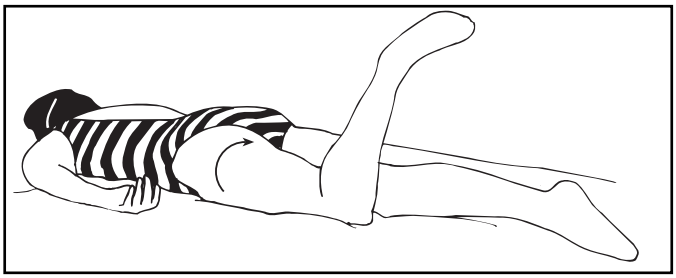

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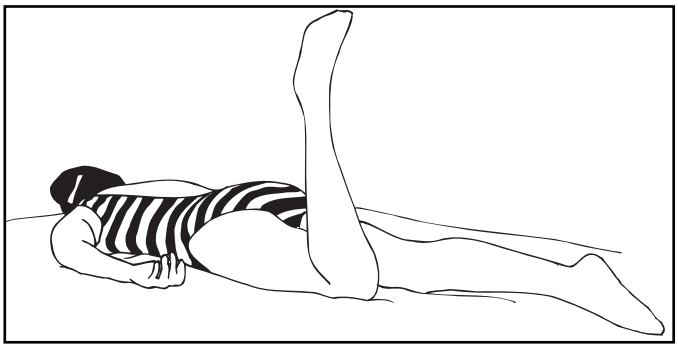

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STAGE IV: SEGMENTAL MOTION OF THE SPINE AND PELVIS: QUADRUPED AND HIGH KNEELING (WEEKS 4 & 5)

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

GOALS:

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

FUNCTIONAL RELEVANCE:

- Posture in sitting and standing.
- Reaching overhead (e.g., high cupboard, overhead light bulb).
- Preparation for dynamic postural (in sitting and standing) and gait control.

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.
The participant assumes a half kneeling position with glenohumeral joint directly over greater trochanter.

SPECIFIC EXERCISES:

- Cat/Camel
- Lateral flexion of the lumbar spine in quadruped
- Rocking forward and backward in the sagittal plane
- Rocking forward and backward in the diagonal plane
- Isolated flexion/extension of the lumbar region
- Quadruped hip extension
- Forward and backward weight shifts in half kneeling

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.

CRITERIA FOR PROGRESSION:

The participant:

- Assumes the quadruped position with good alignment.
- Increases flexion/extension/lateral flexion range of motion throughout the spine.
- Isolates motion in the pelvic, lumbar, thoracic, and cervical regions.
- Is stable in half kneeling and increases hip flexor muscle range of motion.

IV-1 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 until the participant "feels" movement. Participants commonly 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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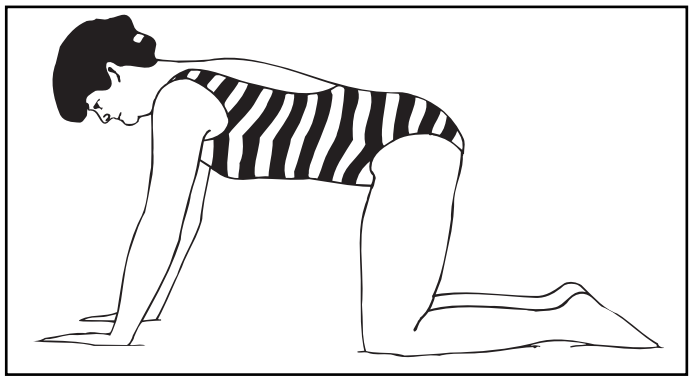

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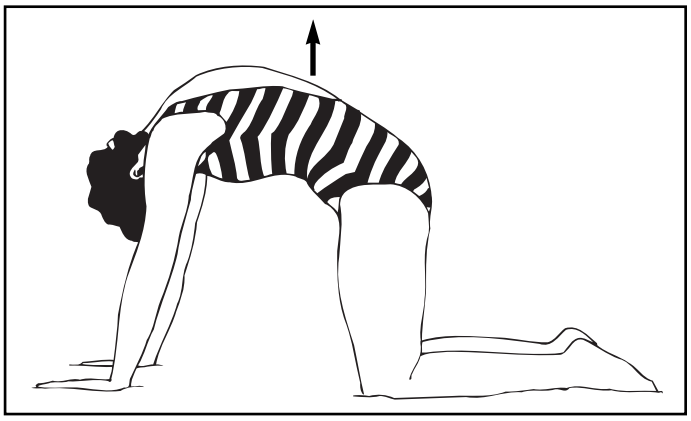

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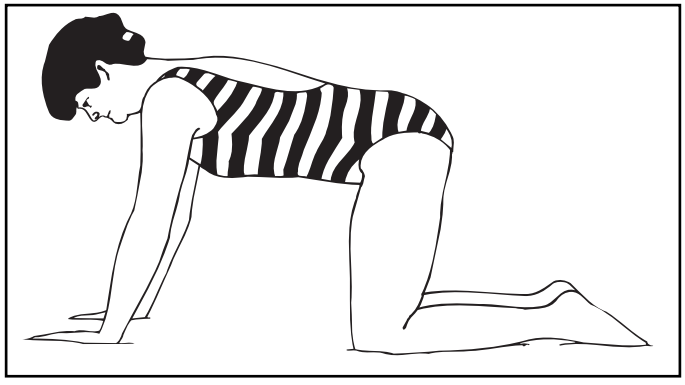

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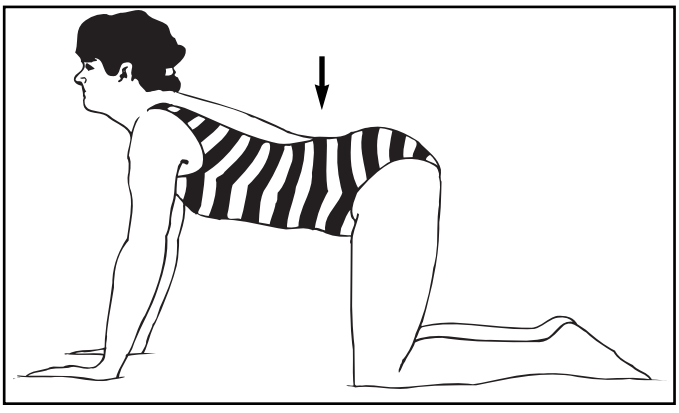

IV-2 LATERAL FLEXION OF THE LUMBAR SPINE IN QUADRUPED

PURPOSE: Increase lumbar lateral flexion range; and improve ability to shift weight from side to side through lower extremities.

The participant assumes a neutral quadruped position, with elbows extended, and slowly laterally flexes pelvis from one side to the other. The thoracolumbar spine should laterally flex without rotation. The weight should shift from predominantly under the right knee to predominantly under the left knee.

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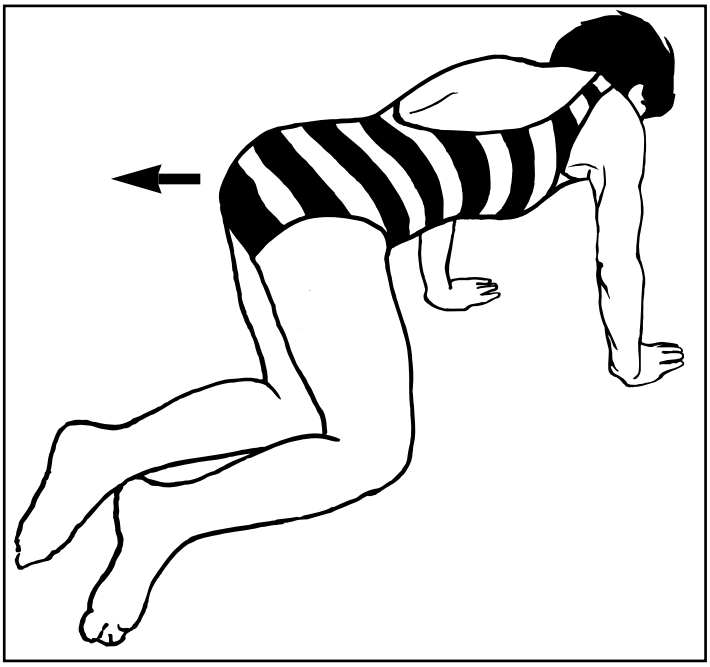

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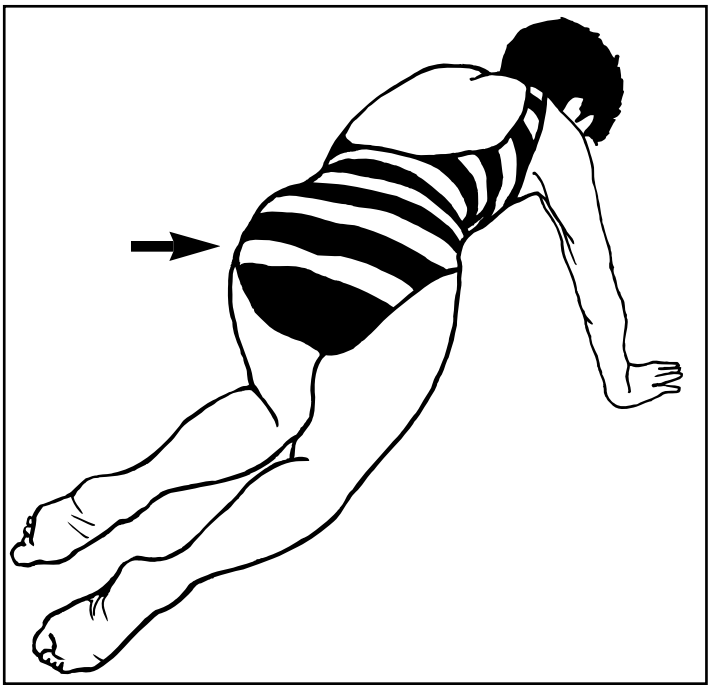

IV-3 ROCKING FORWARD AND BACKWARD IN THE SAGITTAL PLANE

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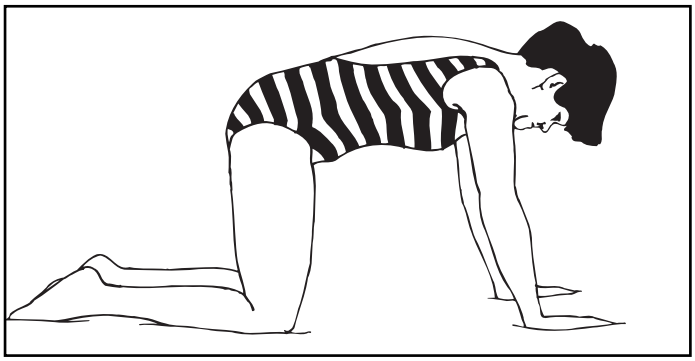

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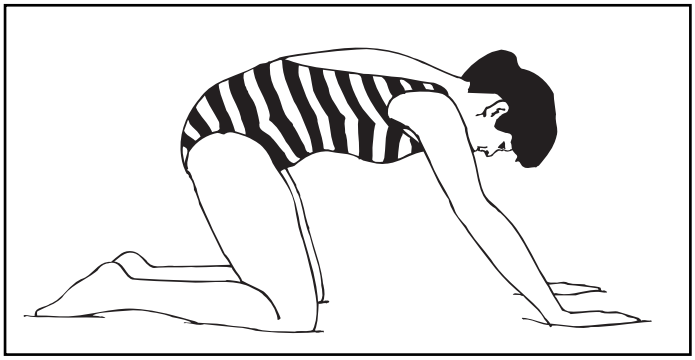

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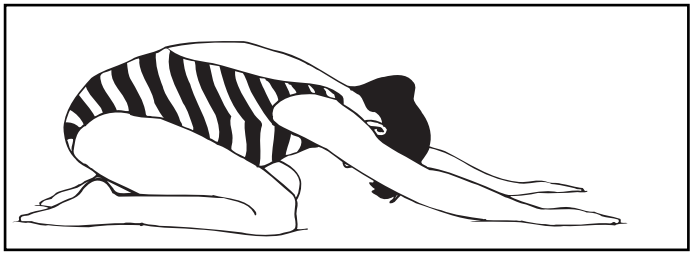

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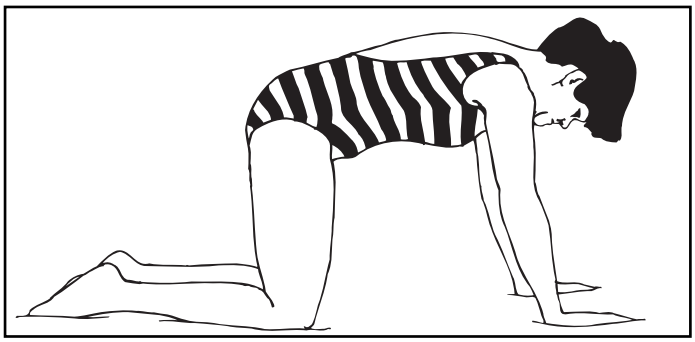

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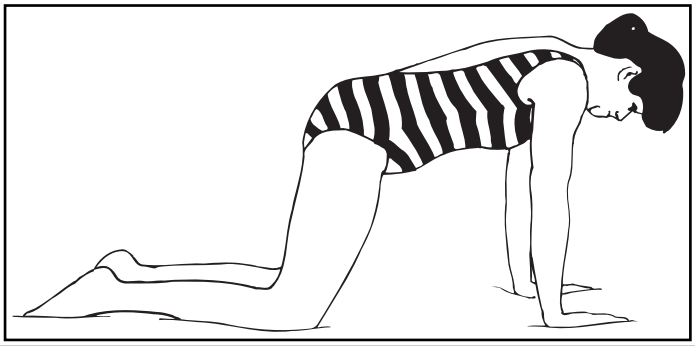

PURPOSE: Stretch the soft tissue structures of the low back, pelvis, hip and shoulder; and increase coordinated movement in less supported positions.

The participant assumes a neutral quadruped 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 forwards and backwards excursion may increase. The therapist may need to limit the amount of movement backwards (depending on the status of the lower thoracic and lumbar region) and/or 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.

Modification: Some participants may be able to perform an advanced variation of this exercise by moving from quadruped to and from prone in a segmental fashion. To do so, the participant gently extends the hips and knees, lowering the pelvis until it is on the support surface. The participant may need to walk the hands forward as the pelvis lowers. The participant then slowly lowers the thorax to the support surface, walking the hands further while flexing the elbows until he or she is in a prone, propped position. The sequence then is reversed until the participant returns to a quadruped position.

IV-4 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; and improve weight shifting from side to side in preparation for postural control in standing.

The participant assumes the neutral quadruped position. S/he performs the rocking motion described in the previous exercise, but with the motion on a diagonal from one hip to the opposite shoulder. The emphasis is movement of 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. Care is taken to avoid excessive stress on the glenohumeral joint.

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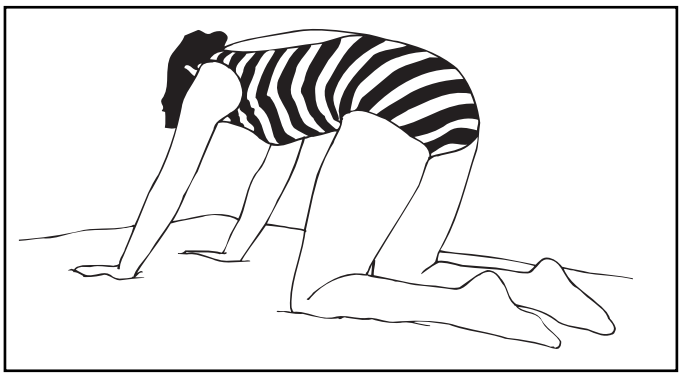

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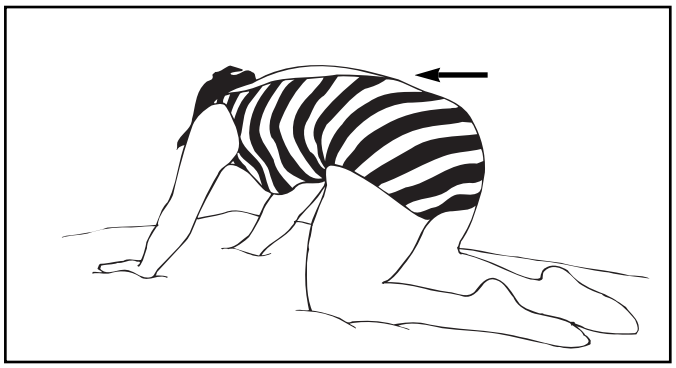

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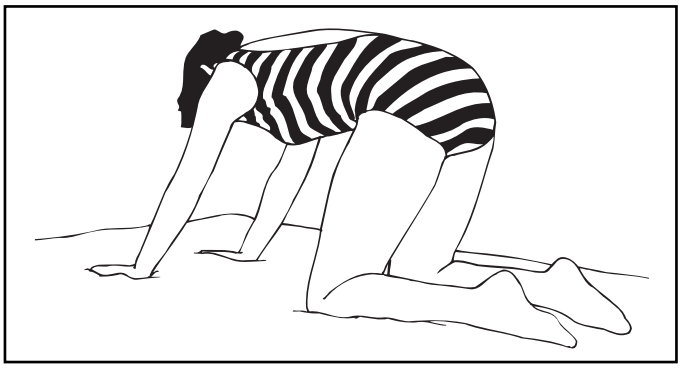

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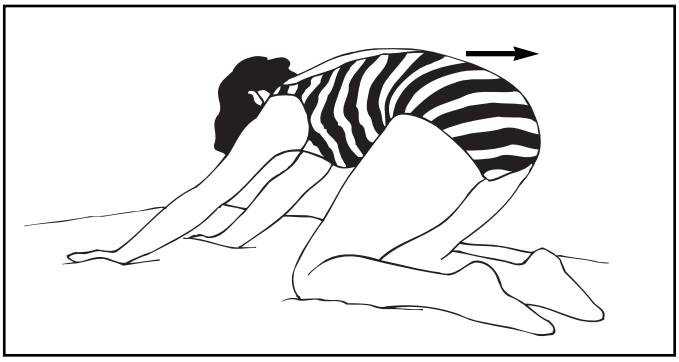

IV-5 ISOLATED FLEXION/EXTENSION OF THE LUMBAR REGION

PURPOSE: Isolate motion of the lumbar and 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.

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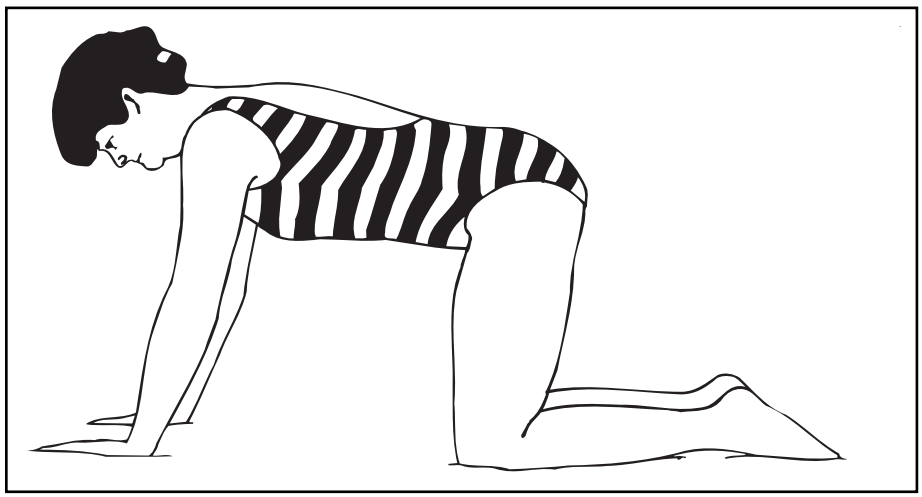

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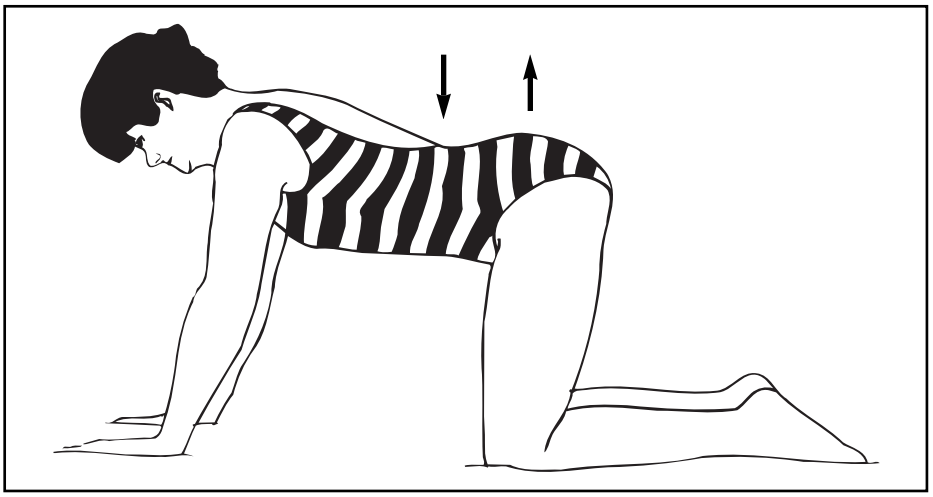

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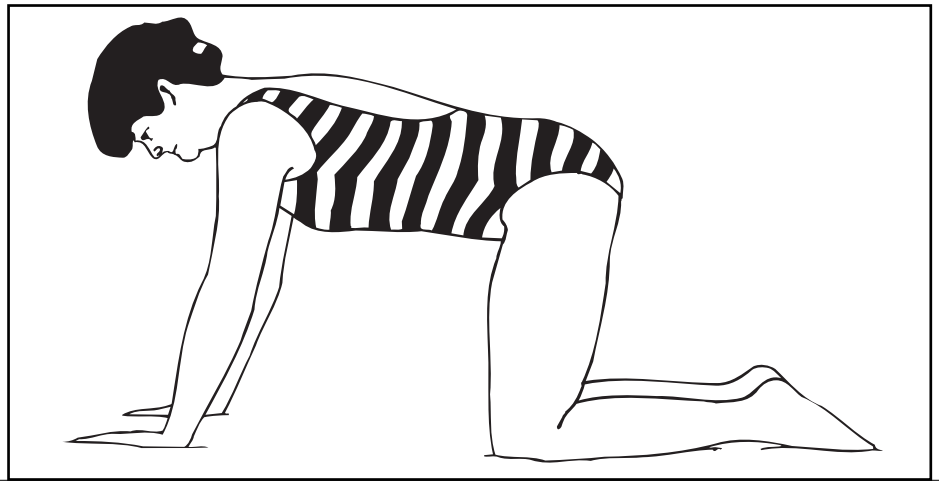
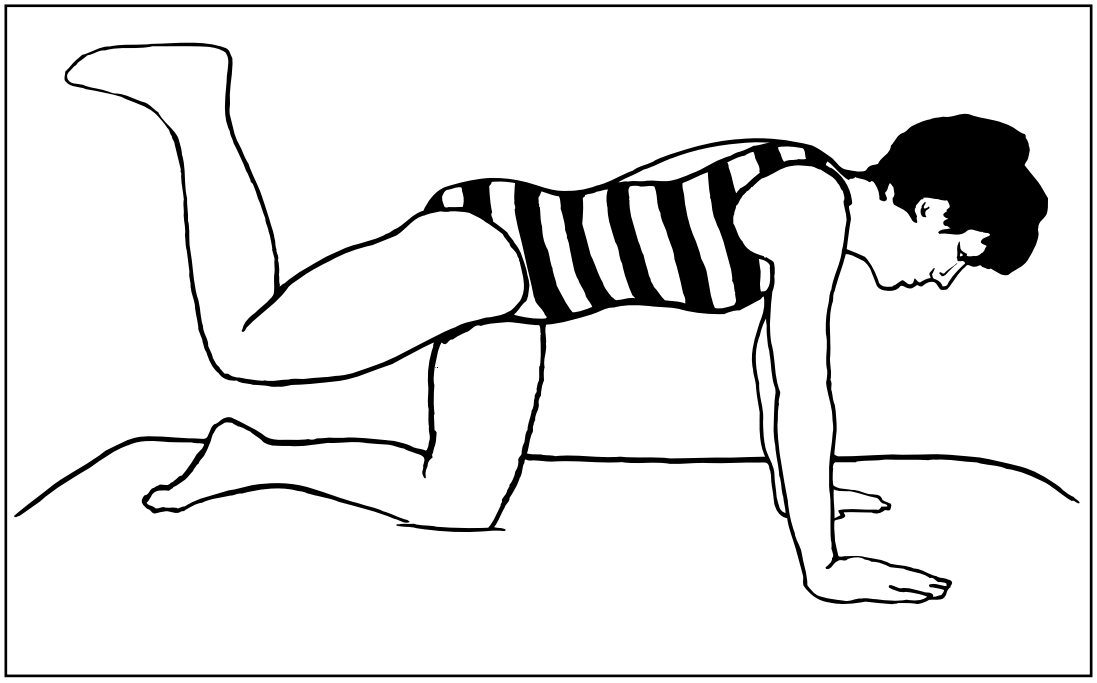


Note: This exercise is advanced training and is only appropriate for some participants. The therapist should make sure that hip flexion occurs.

IV-6 QUADRUPED HIP EXTENSION

Purpose: Increase strength of hip extensor musculature with controlled stability from the muscles of the trunk and pelvic girdle.

The participant assumes a neutral quadruped position, with elbows extended. S/he extends one hip, with knee flexed, assuming a position of neutral hip extension relative to the pelvis. S/he holds this position for 15 seconds, and then relaxes. Neutral alignment of the spine should be retained throughout the exercise. This exercise is repeated three to six times and then repeated with the opposite extremity.



IV-7 FORWARD AND BACKWARD WEIGHT SHIFTS IN HALF KNEELING

Purpose: Increase length and flexibility of anterior hip and thigh musculature; improve balance control.

The participant assumes a half kneeling position, with one knee / lower leg and the opposite foot on the support surface. The upper body is erect and the spine is neutral. S/he extends the hip of the kneeling extremity by moving forward from the pelvis until there is a good stretch of the anterior muscles of the thigh and the hip is in extension (Fig. 1). The position is maintained for 10-15 seconds, after which the participant relaxes, sitting back toward his or her heel (Fig. 2). This exercise is repeated several times and then repeated to the opposite side.

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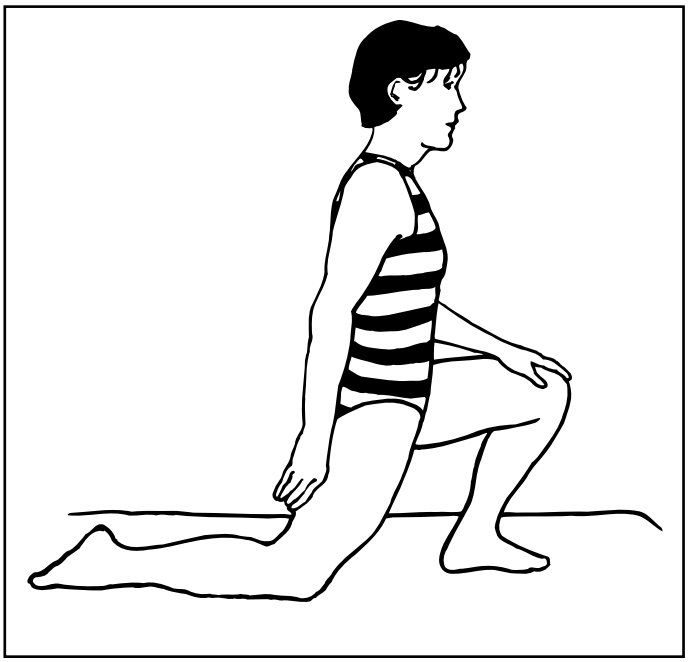

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STAGE V: SEGMENTAL MOTION OF THE SPINE AND PELVIS: SITTING (WEEKS 6 & 7)

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 to increase the difficulty of the task without introducing the demands for balance control that occur when standing.

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

FUNCTIONAL RELEVANCE:

- Preparation for dynamic balance in the seated position
- Sit to stand

POSITION:

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

SPECIFIC EXERCISES:

- Forward trunk flexion over a stable pelvis
- Diagonal trunk flexion over a stable pelvis
- Lateral flexion of trunk on pelvis
- Isolated anterior/posterior pelvic tilt
- Lateral tilt of the pelvis relative to the trunk
- Pelvic clock

FUNCTIONAL MOBILITY TRAINING:

The participant practices moving from sitting to standing with good mechanics and smooth coordinated movement. Emphasis is on maintaining neutral alignment of the spine throughout the task. This should be practiced under a variety of conditions (e.g. varied speeds, chair heights, and with/without use of the upper extremities.

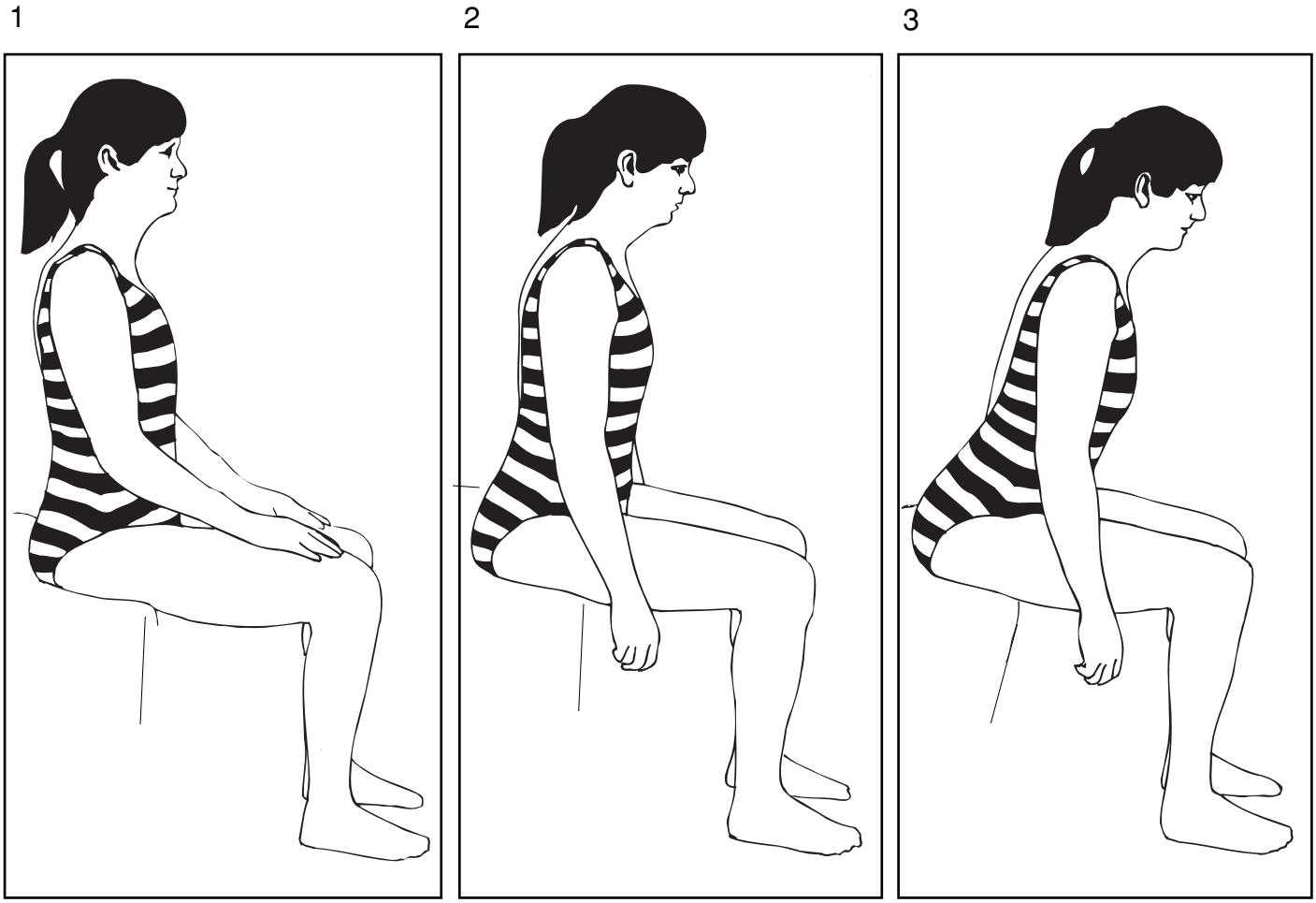
CRITERIA FOR PROGRESSION:

- 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.

V-1 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; prepare for moving from sitting to standing.

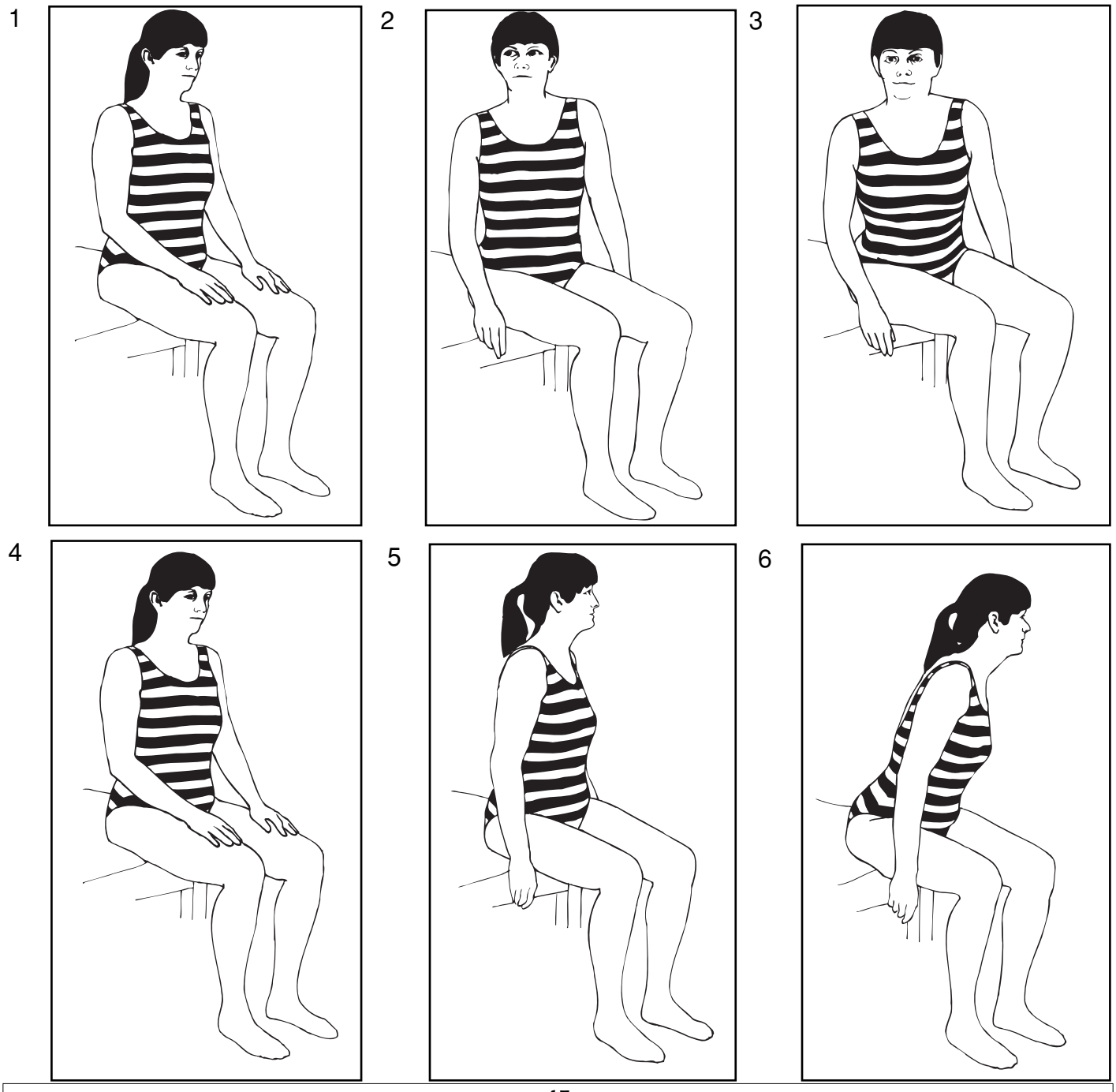
The participant retains a neutral posture of the cervical, thoracic, and lumbar spine. S/he then stabilizes the torso so that neutral alignment is maintained while flexing the pelvis forward over the femurs. The goal is to maintain extension of the spine while flexing the hips. Initially, this exercise should be performed through small ranges; as more motion is obtained in the pelvic region, the forward excursions may increase. The participant should be cautioned to avoid excessive lumbar lordosis; the spine should remain in a neutral position throughout the exercise.



V-2 DIAGONAL TRUNK FLEXION OVER A STABLE PELVIS

PURPOSE: Develop ability to shift weight from one side of the pelvis to the other with coordinated control and symmetry; increase hip ab/adduction and extensor range of motion; develop ability to coordinate complex lumbo-pelvic motion for balance control through small displacements of the trunk.

The participant initiates movement from the pelvis. First the pelvis rotates to the right over the fixed extremity. The entire trunk follows, rotating to the right, allowing weight to shift to the right buttock. Finally, the trunk is flexed forward over the right femur in a diagonal plane. The thorax is stabilized as in the previous exercise. Repeat the movement to the left.



V-3 LATERAL FLEXION OF TRUNK ON PELVIS

Purpose: Experience weight shift onto one side of the pelvis; increase extensibility of the lateral trunk musculature.

The participant begins in neutral alignment. S/he laterally flexes the spine, initiating the movement from the pelvis. The thorax should move in the coronal plane only. Hold this position, then repeat several times. Repeat to the opposite side.

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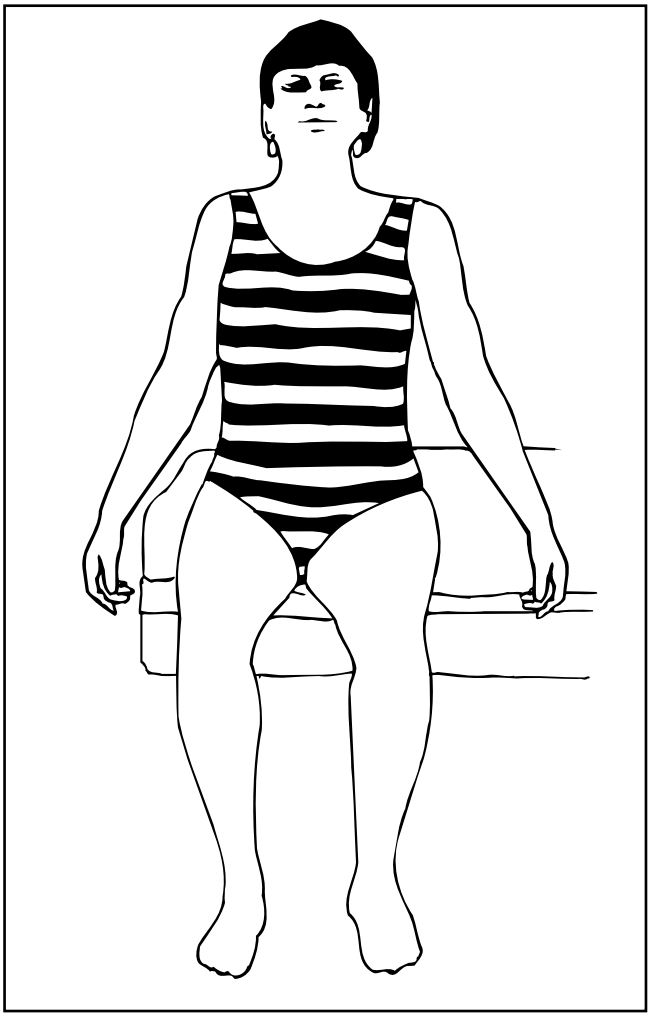

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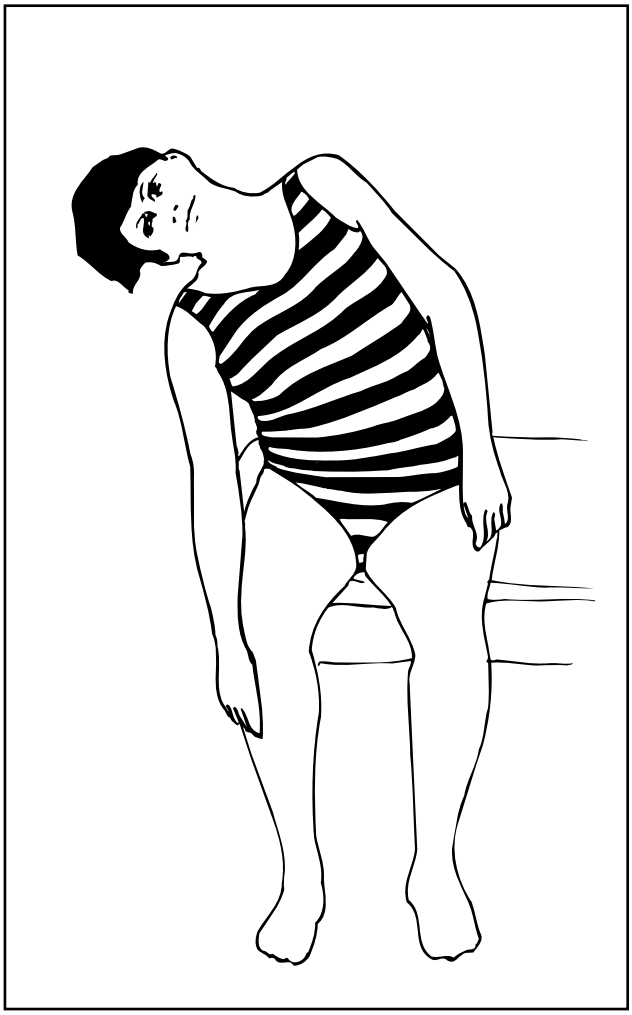

V-4 ISOLATED ANTERIOR/POSTERIOR PELVIC TILT

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

The participant performs an anterior/posterior 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 backward. Verbal and manual cues may be helpful until the concept is understood. One technique that may help the participant recognize motion in the lumbar region, is to have her/him assume a slouched position, and then sit erect with emphasis on slight lumbar extension. The instructor places his or her hands over the lateral aspects of the pelvis and/or on the lumbar spine and assists the participant through the movement. Once the participant is able to assume and hold an anterior pelvic tilt, s/he should practice maintaining that position while moving from sitting to standing.

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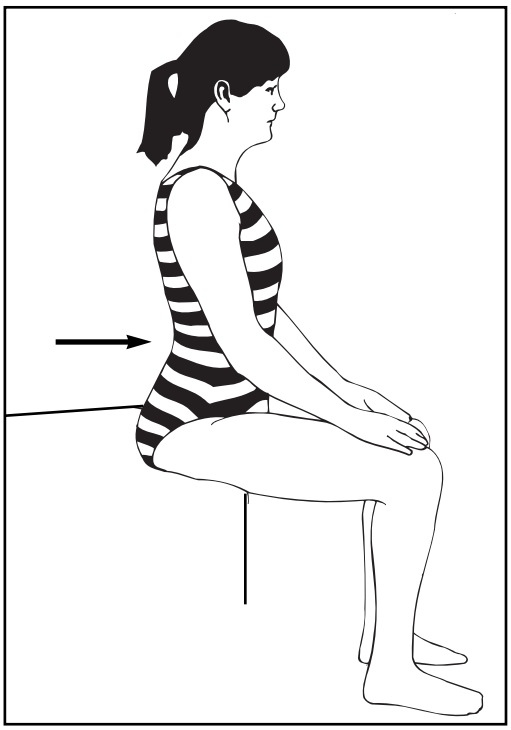

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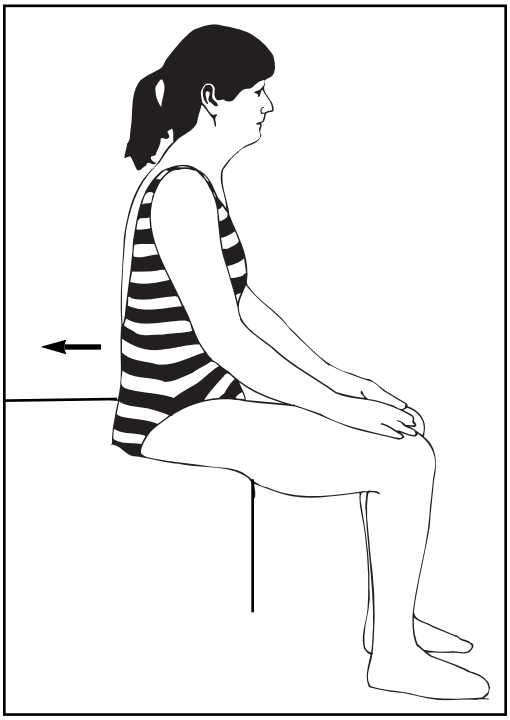
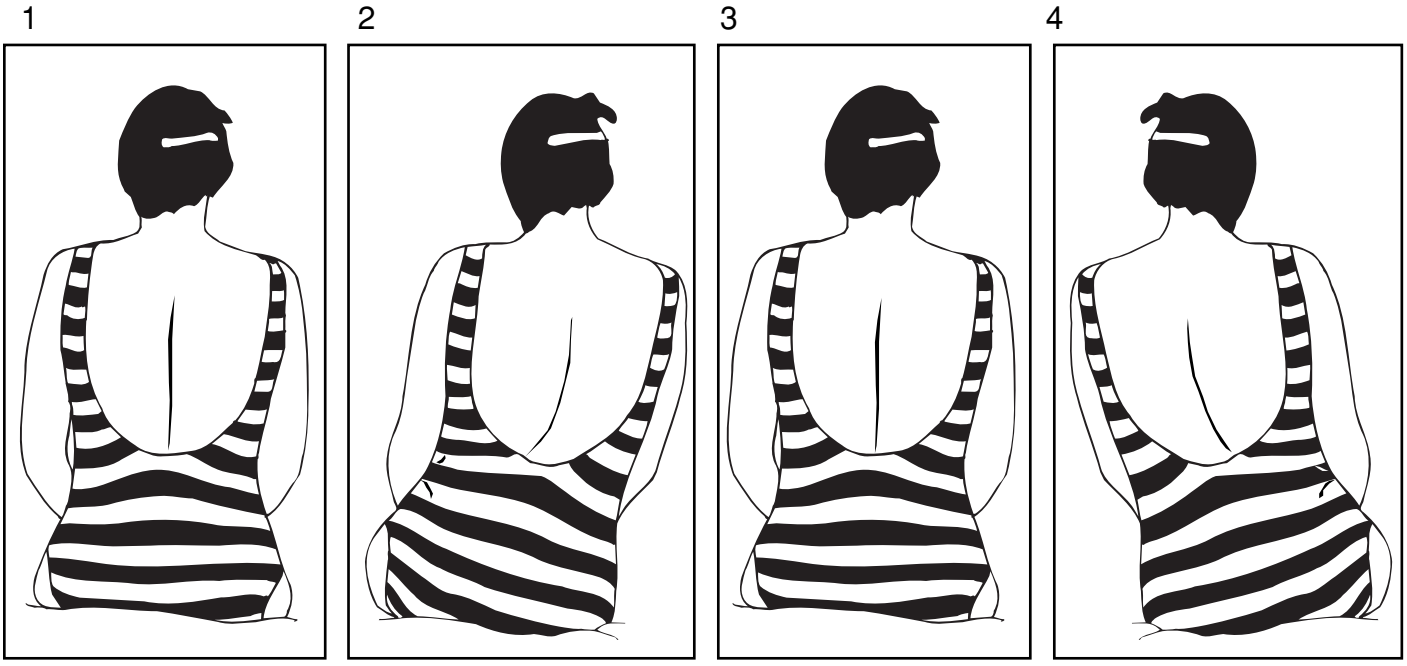


V-5 LATERAL TILT OF THE PELVIS RELATIVE TO THE TRUNK

PURPOSE: To isolate lumbar lateral flexion in sitting.

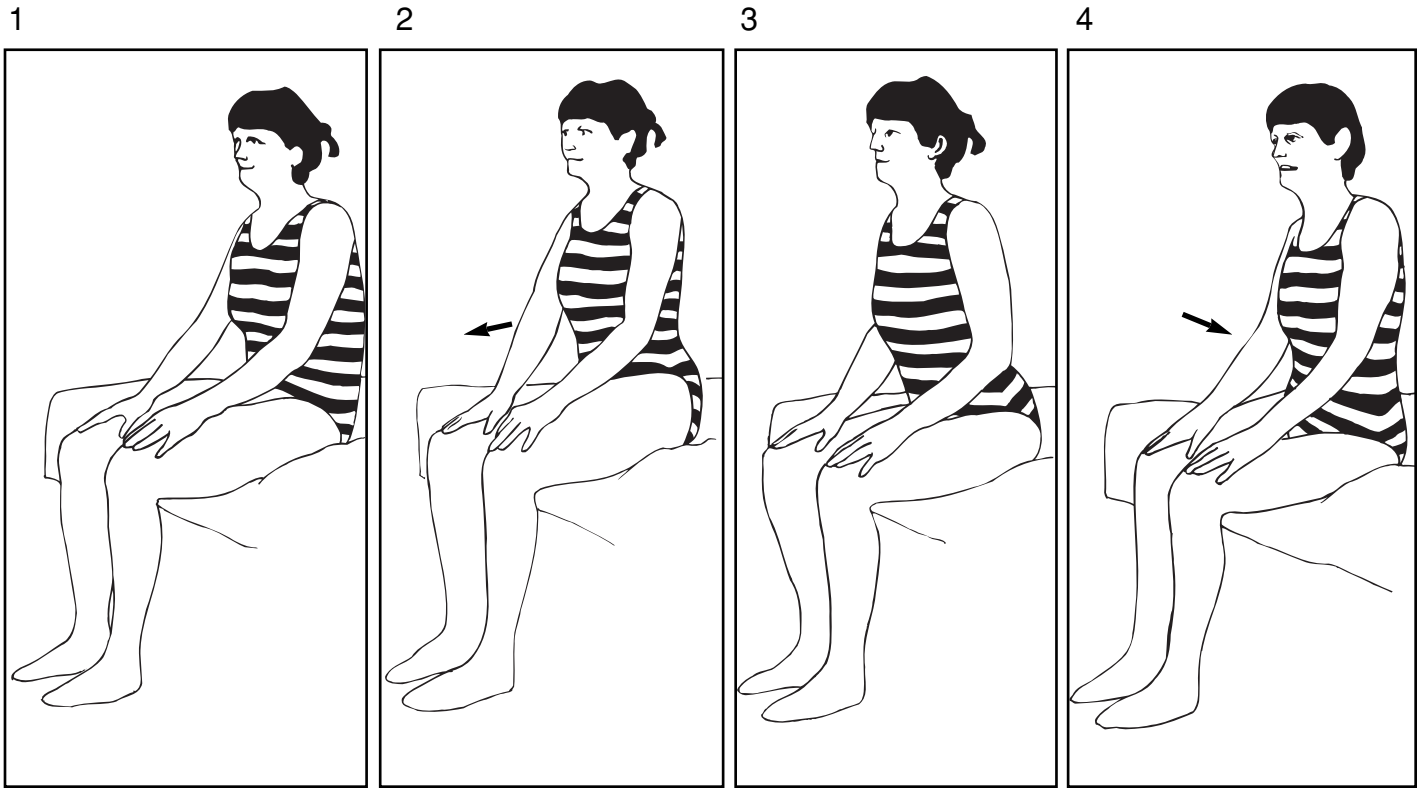
The participant shifts weight onto one buttock by laterally flexing lumbar spine relative to the thorax. This causes body weight to shift onto one buttock. The trunk moves only in the coronal plane. The therapist assists the participant to help them recognize the difference between shifting weight onto one buttock through lumbar lateral flexion (as in this exercise) versus through lateral flexion, initiated from the shoulder (i.e., the exercise: V-3 Lateral Flexion of the Trunk on Pelvis.)



V-6 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. The head and shoulders should remain relatively stationary relative to the support surface. This is repeated several times in a smooth and coordinated manner. The participant then repeats the motion in a counterclockwise direction.



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.

GOALS:

- Perform coordinated movements of bilateral upper extremities and trunk.
- Maintain an erect posture and shift weight from the pelvis as the movement is performed.

FUNCTIONAL RELEVANCE:

- Dynamic balance in the seated position
- Reach floor to pick up objects
- Reach foot to put on shoe or sock
- Preparation for dynamic balance in standing

POSITION:

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

SPECIFIC EXERCISES:

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

FUNCTIONAL MOBILITY TRAINING:

1. Practice putting on shoes and socks using trunk and hip flexion while keeping the pelvis in neutral.

2. Sitting Reach:

Sit in neutral alignment and place or retrieve objects that require reaching forward, diagonally to the left and right, and posteriorly. Combine 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.

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.

VI-1 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 entire spine, shoulders and pelvis should participate in the motion. Verbal cues to look behind him/herself can help incorporate all segments. Once the participant is proficient in the task, s/he can hold light weights in each hand, progressively adding more weight as tolerated.

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VI-2 TRUNK EXTENSION FROM A FLEXED POSITION

PURPOSE: Segmental extension while bearing weight through the feet.

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 (raising the arms, flexing the elbows to 90 degrees, adducting the scapulae without shrugging the shoulders); third, the lumbar spine. To complete the movement, the participant extends at the hips, ending in 90 degrees of hip flexion, with the spine in a neutral position. During this motion, 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. Once the participant is proficient in the task, s/he can hold light weights in each hand, progressively adding more weight as tolerated.

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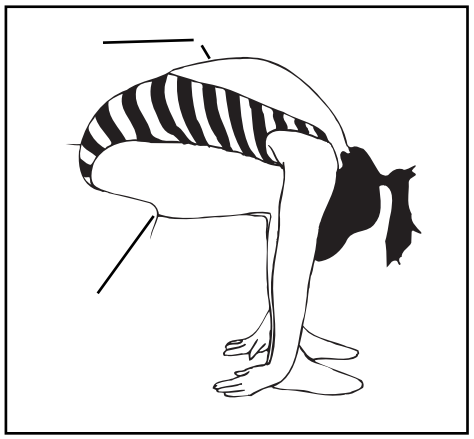

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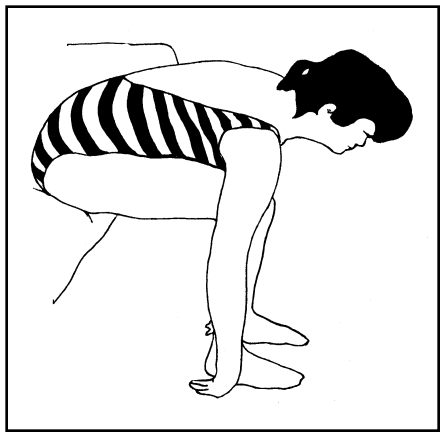

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VI-3 TRUNK FLEXION AND EXTENSION IN THE DIAGONAL PLANE

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. At the midpoint of this motion, the participant's upper extremities should be flexed to approximately 90 degrees, without abduction or adduction of the shoulders. The elbows should be extended. Weight should be equally distributed on the two buttocks and the spine should be neutral.

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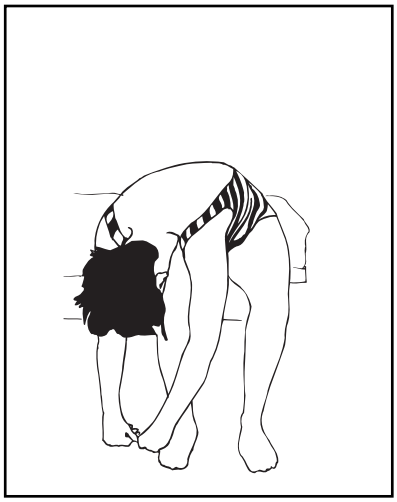

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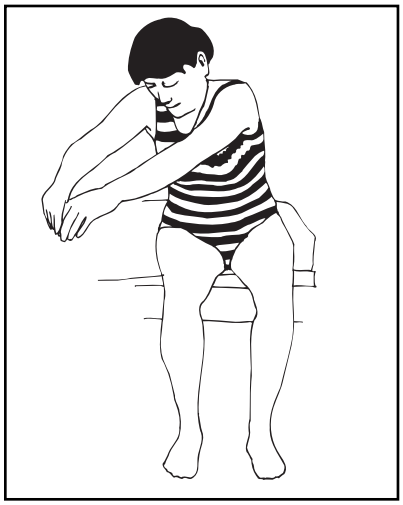

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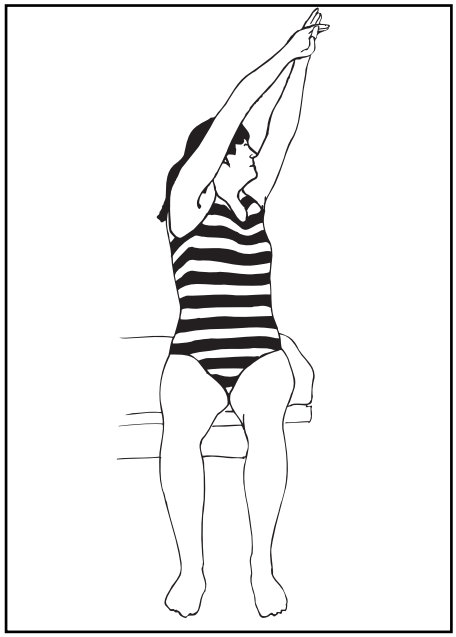

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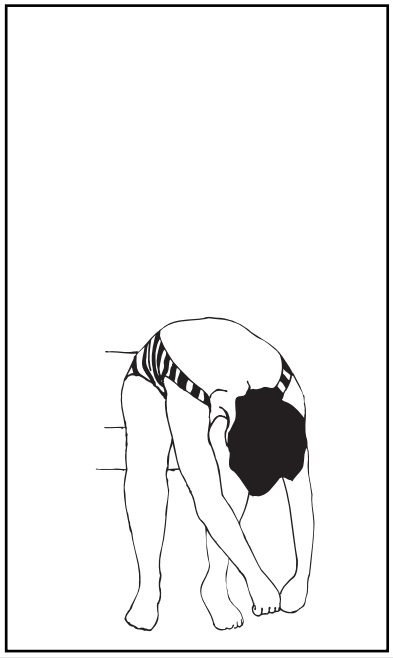

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STAGE VII: AXIAL MOBILITY IN STANDING (WEEKS 9 - 12)

The three categories of exercises in this stage advance 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 helpful.

GOALS:

- The participant uses 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.

FUNCTIONAL RELEVANCE:

- Dynamic balance in standing
- Improved gait

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.

SPECIFIC EXERCISES:

I. GENERAL LUMBO-PELVO-FEMORAL MOTION

- Lateral trunk flexion
- Relaxed trunk and lower extremity rotation

II. ISOLATED LUMBO-PELVO-FEMORAL MOTION

- Lateral trunk flexion
- Lateral pelvic tilt
- Relaxed trunk and lower extremity rotation
- Isolated upper trunk rotation
- Standing pelvic clock

III. INITIATING MOVEMENT WITH THE PELVIS

- Forward and backward weight shifts
- Forward and backward stepping in place and stepping through

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.

3. Dancing
The participant practices box steps, waltz steps, and other dance steps, paying close attention to incorporating shifting of weight and trunk rotation.

VII-1 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 knee on the side of the concavity may flex slightly to accommodate the movement. 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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VII-2 LATERAL PELVIC TILT

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. Once the participant gains control of this movement, s/he performs the activity without support from the chair.

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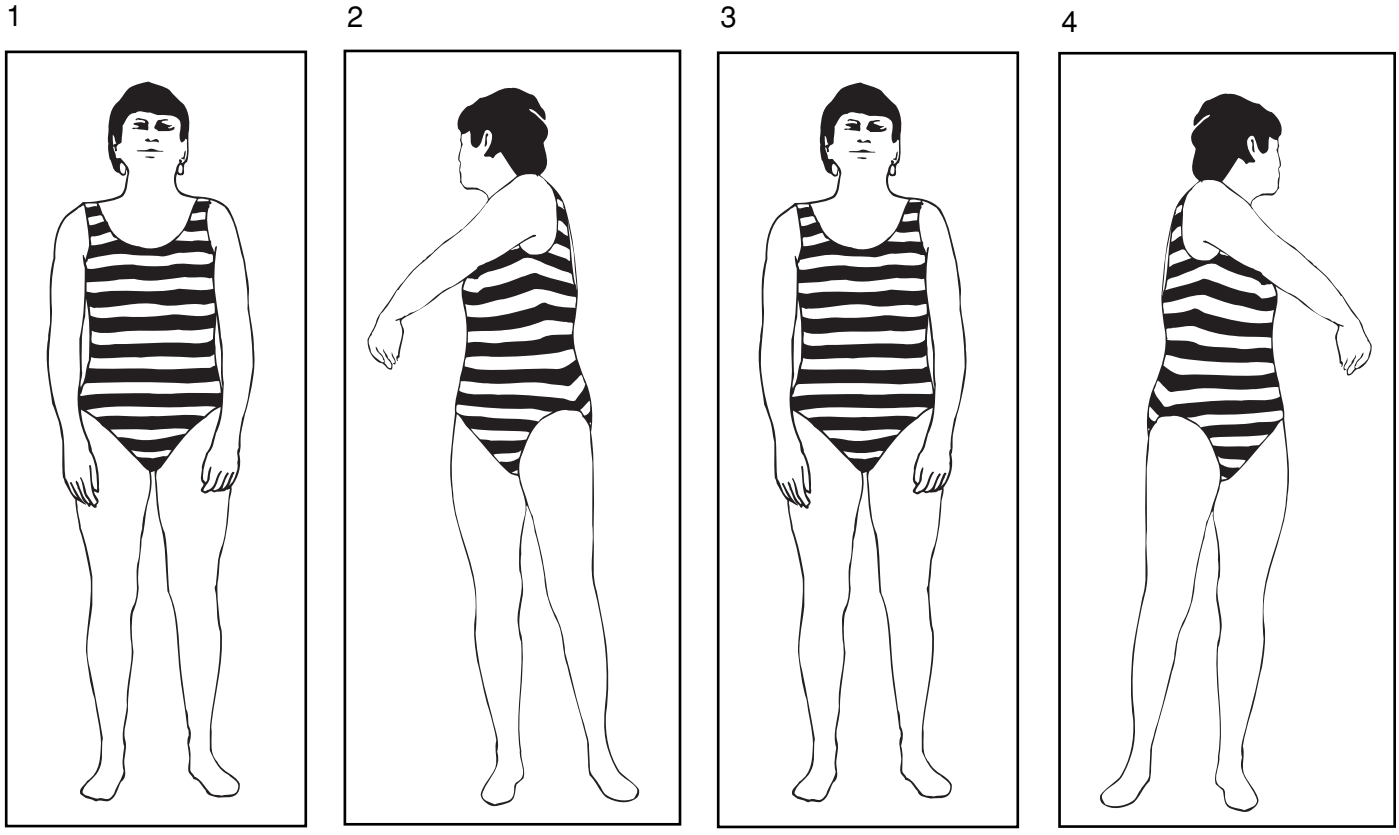
VII-3 RELAXED TRUNK AND LOWER EXTREMITY ROTATION

PURPOSE: To achieve relaxed rotation in standing including: coordinated transverse plane rotation of the thoracolumbar spine, internal and external rotation of the femur, and supination / pronation of the feet.

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.



VII-4 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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VII-5 STANDING PELVIC CLOCK

PURPOSE: Isolated pelvic movement in all planes in standing

The participant stands and moves the pelvis from an anterior to a lateral and a posterior tilt, and then a lateral tilt to the opposite side. The feet supinate and pronate to accommodate the movement. 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.

VII-6 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. The participant holds this position for a few seconds and then returns to the initial position, by shifting weight posteriorly. When shifting the weight in the posterior direction, 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.

Modification: If the participant has difficulty with this task, s/he can start by standing facing a wall with the leading foot about 12 inches from the wall. Rest hands lightly on the wall and bring the pelvis toward and away from the wall. Repeat several times, then lead with the opposite foot and repeat.

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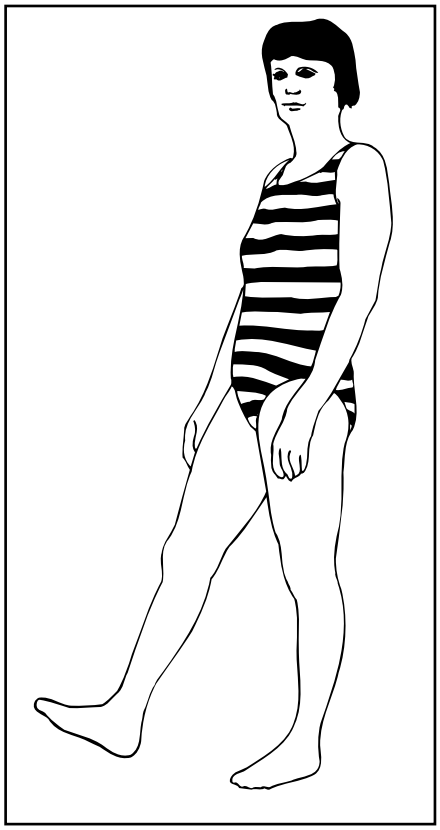

VII-7 FORWARD AND BACKWARD STEPPING IN PLACE

PURPOSE: To develop coordinated weight shift during stepping, both to translate the body forward and to translate backwards.

The participant performs the Forward and Backward Weight Shifts several times. On the third time, s/he takes a full step through with the back foot, planting that foot on the ground, and then steps back to the original position. As s/he steps through, the weight should move smoothly over the stance foot, and should be over the mid foot of the stance extremity as the swing extremity passes the middle of the base of support. The participant repeats this maneuver several times and then leads with the opposite foot and repeats the exercise.

Next the participant performs the Forward and Backward Weight Shifts several times. On the third time, s/he takes a full step through with the back foot, planting that foot on the ground. From this new position, s/he again performs the Forward and Backward Weight Shifts, taking a full step through after about three weight shifts. This is continued a few more times as the participant continues to advance forward from the starting position.

Finally, the participant practices walking backwards. In backwards walking, the participant should flex at the hips to maintain weight over the stance foot until the (backwards moving) swing extremity is securely planted on the ground. This strategy for walking backwards should become second nature so that the participant is never at risk for falls when backing up.

VII-8 DYNAMIC ACTIVITIES

PURPOSE: To incorporate 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 should choose activities that emphasize components from previous exercises, and that 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
- 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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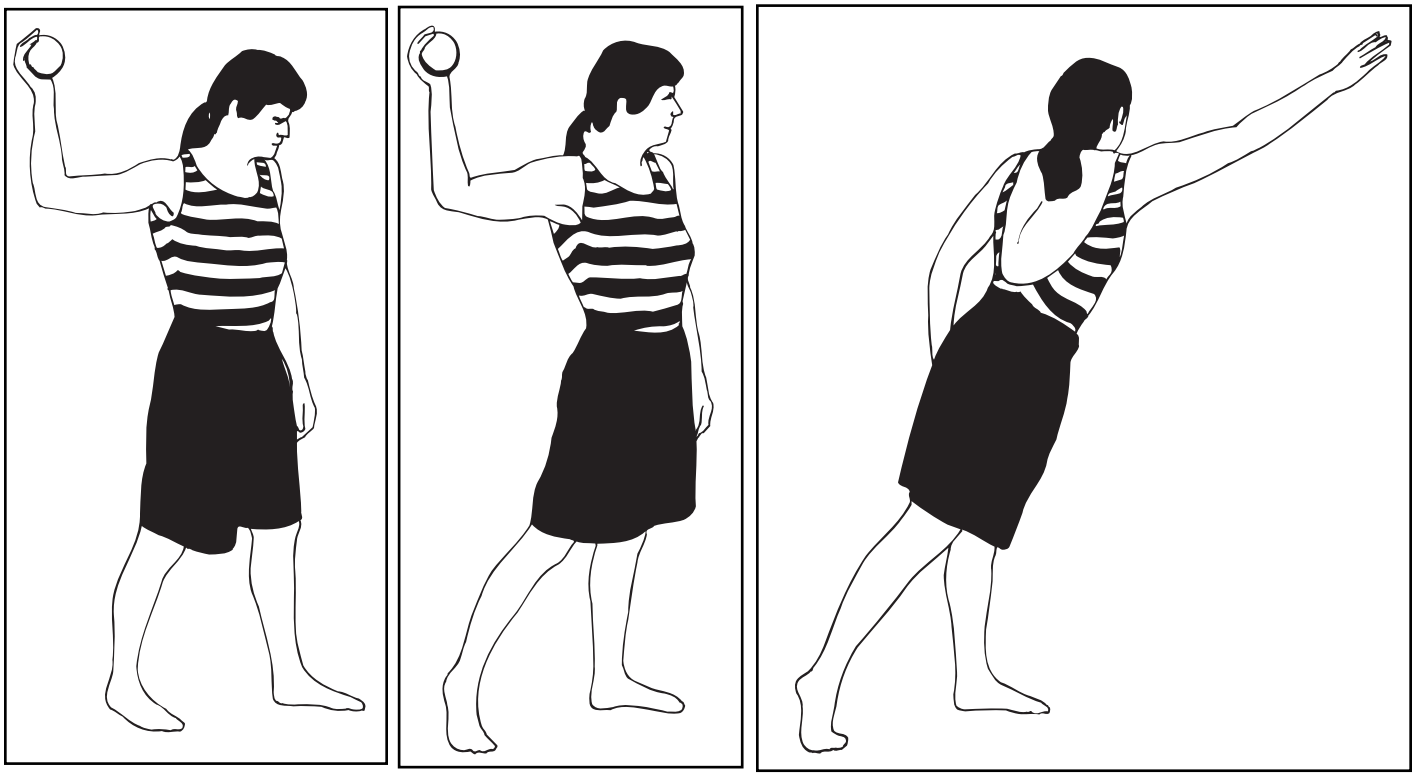


STRETCHING EXERCISES

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.

Several options are provided for most of the stretches. The instructor decides with the participant which method will be most effective and easiest for the participant to accomplish. Participants are recommended to hold each stretch 20 to 30 seconds and to repeat each exercise two to three times to each side.

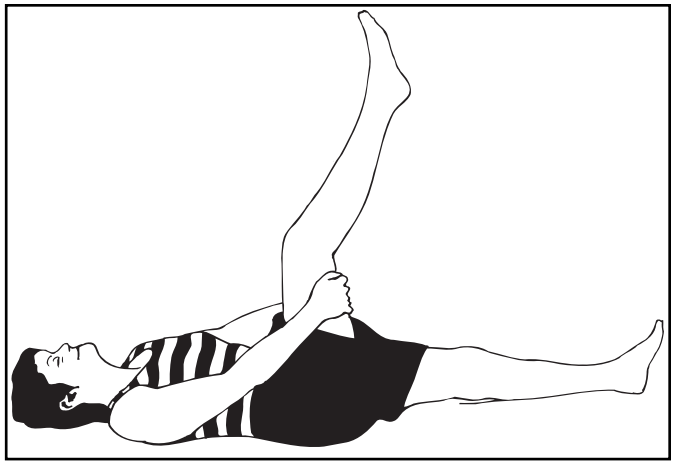
1. Hamstrings

Method A

Position: Participant is supine, with one knee flexed towards the chest; participant holds the back of the thigh with his / her hands.

Action: Participant extends the knee, raising the foot towards the ceiling until s/he feels a comfortable stretch behind the knee and thigh.

hamstrings



hamstrings

Method B

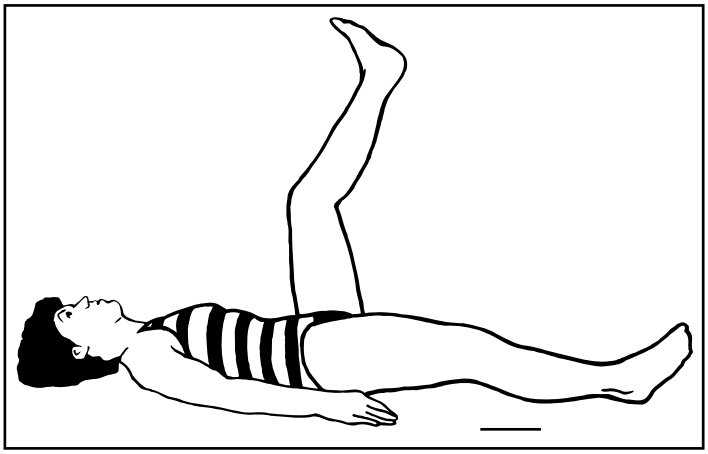
Position: Participant sits up straight on the edge of a chair, with one leg out straight, heel resting on the floor, or a low stool or book.

Action: By sitting up straight and keeping the knee straight, s/he will feel a stretch behind the knee and thigh. For more stretch, the participant is instructed to lean forward while keeping the back straight.

Method C

Position: The participant lies on the floor in a doorway with his or her buttocks as close as possible to the door jamb. One leg is out straight on one side of the door jamb, the heel of the other leg is on door jamb with the knee as straight as possible.

Action: The participant straightens the knee as far as possible.



hamstrings

2. Calf

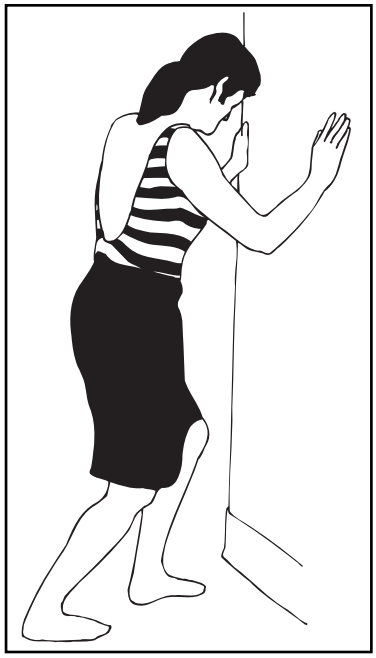
Position: The participant stands with hands on wall 6 - 12 inches away, both feet pointing straight ahead, with one foot about 12 inches behind the other.

gastrocnemius

Action:

A) The participant leans forward, keeping his/her back leg straight and heel on the ground. The participant should feel a stretch in the calf of his/her back leg.

B) Maintaining the position above, the participant bends both knees, keeping heels on the ground. S/he should feel a stretch in the lower calf of the back leg.



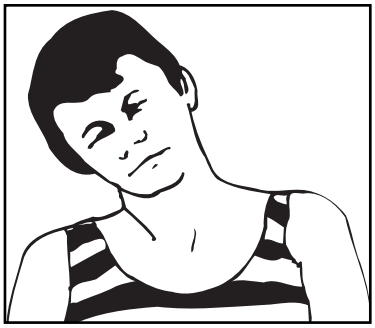
soleus

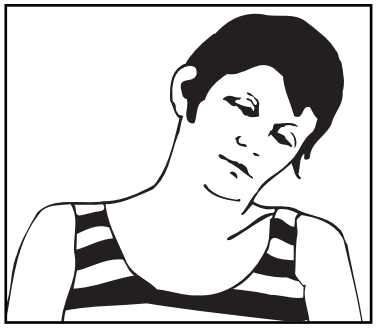
3. Feet

Position: The participant sits up straight on the edge of a chair, one foot resting on a small can.

Action: The participant gently rolls the can forward and backward under the foot to relax and stretch the muscles on the bottom of the foot.

Action B: Side Tilts
The participant glides the head backward as in A. Then, slowly s/he laterally flexes so that the head is tilted to one side, bringing the ear toward shoulder. S/he is instructed to keep eyes forward. This is repeated to the opposites side.





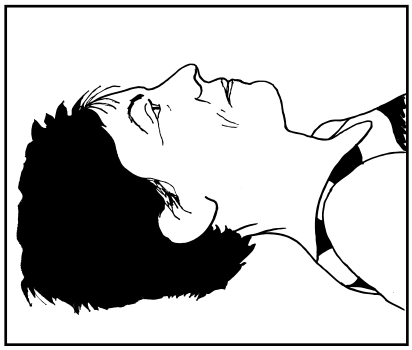
Action C: Rotation
The participant glides the head back as in A. Then s/he turns the head slowly from side-to-side.

4. Neck

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. The participant assumes an erect posture (slight lumbar lordosis with extended thoracic spine). She/he drops the chin slightly, and drawing the chin in towards the spine to achieve extension of the cervical spine. This is repeated several times. The participant also laterally flexes and rotates the cervical spine with the emphasis on good alignment and posture.

Position A: Lying on a firm surface with arms resting comfortably and legs straight.

Action: Participant brings the chin down toward the support surface to stretch out the muscles around your neck. S/he holds that position, relaxes, and repeat several times.



Position B: Sitting on a firm chair with back straight and feet flat on the floor.

Action: A: The participant glides the head backwards so that ears are lined up with glenohumeral joint. S/he is instructed to keep the head neutral.

Correct Head Posture

Poor Head Posture