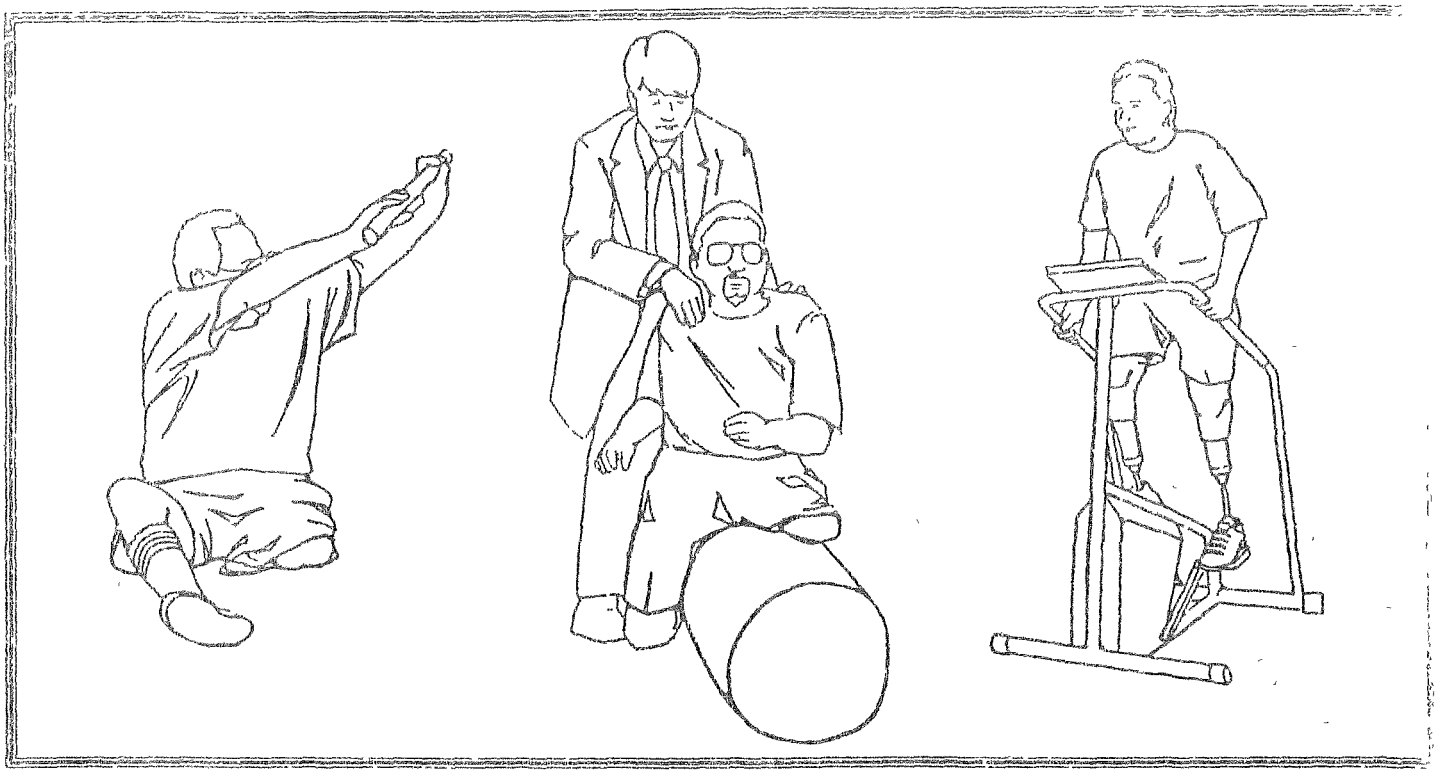
BALANCE, AGILITY, COORDINATION AND ENDURANCE

FOR LOWER EXTREMITY AMPUTEES



ADVANCED REHABILITATION THERAPY INCORPORATED

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Illustrations by:
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General Criteria for the Five Phases of a Functionally Progressive Amputee Rehabilitation Program

Phase I Immediate postoperative stage. Syme and below-knee amputees may be immobilized in a rigid dressing or an immediate postoperative prosthesis (IPOP) in some settings. The residual limb presents with edema, is frequently hypersensitive to touch, and is weak. Basic bed mobility, transfers and self care skills must be taught. Mobility is with a wheelchair or ambulation with an assistive device. The amputee should be educated in residual limb wrapping, proper bed and chair positioning, as well as wound and residual limb care.

Phase II Immobilization is removed. Edema and hypersensitivity will still be present in the residual limb. Residual limb strength continues to be weak and ROM must be closely monitored. Patient is independent with bed mobility, transfer skills and wheelchair mobility, or ambulation with an assistive device. Has not been casted or fitted with prosthesis but is performing preprosthetic exercise program. Requires education for prosthetic alternatives, nutrition, support groups and social services if necessary.

Phase III Intermediate rehabilitation stage. Subtle fluctuations with edema and hypersensitivity. Residual limb wrapping continues. 50 to 90% of strength returns during this phase. ROM is maintained through a self stretching program. This is the temporary prosthetic fitting period. Weight bearing activities and prosthetic gait training are provided. Prosthetic and residual limb care should be discussed at this time.

Phase IV Advanced rehabilitation stage. Edema and limb sensitivity is stable, although residual limb wrapping may continue. Strength returns, independent prosthetic ambulation with or without an assistive device, minor difficulty with weight-bearing. Agility and endurance training become a major focus. All higher level functional skills including stairs, ramps and floor to stand transfers are practiced. Community or employment reintegration. Appropriate therapeutic problem solving techniques are discussed as necessary.

Phase V Return to work or pre-amputation life style. Independent prosthetic ambulation with or without an assistive device depending on the individual amputee. Programs for strengthening, stretching, agility and endurance are performed independently utilizing resources that will be readily available to the amputee on a regular basis. The pursuit of recreational activities is practiced or discussed.

Table 1. Functional Progressive Exercise Rehabilitation for Amputees

	Phase I	Phase II	Phase III	Phase IV	Phase V
Warm-up	UE ergometer calisthenics in sitting	UE or LE ergometer sound limb calisthenics in sitting	LE ergometer sound limb	LE ergometer both LEs	treadmill stairclimber LE ergometer
Modalities	TENS, ice pain relief	TENS, ice ultra sound pain or phantom pain relief	PRN	PRN	none
Tissue Preparation	desensitization edema reduction	desensitization edema reduction scar tissue massage	PRN	PRN	none
Stretching	PROM if possible	PROM	self stretching program	self stretching program	self stretching program
Strengthening	isometrics UE PREs	multiangle isometrics LE & UE PREs	LE & UE PREs slow speed VSRP isokinetics	LE & UE PREs high speed VSRP isokinetics	LE & UE PREs
Balance	sitting activities	sitting quadruped kneeling	quadruped kneeling standing	standing ambulatory activities	ambulatory activities
Coordination	sitting activities	sitting quadruped kneeling	quadruped kneeling standing	standing ambulatory activities	ambulatory activities
Agility	WC mobility	WC or amb with assist device around obstacles	turning, side stepping, and braiding	change of direction, figure-8s and obstacles	speed drills designed for specific recreational activities
Gait	WC amb with assist devices limited weight bearing with IPOP	WC amb with assist devices amb with IPOP or pneumatic walking devices	initial to intermediate prosthetic gait training	advanced gait training activities	ambulation endurance running
Functional Activities	bed mobility transfer skills	curbs ramps stairs falling floor to chair with assist device	curbs falling floor to chair independently	ramps stairs falling floor to standing uneven terrain	work and recreational activities
Endurance	UE ergometer	UE ergometer	LE ergometer sound limb swimming	swimming walking cycling stairclimber	swimming walking cycling running
Cool Down	relaxation	Light UE ergometer stretching relaxation	light LE ergometer stretching relaxation	light stretching	light walking stretching
Education	emotional adjustment positioning stump wrapping wound care foot care	nutrition prosthetics support groups social services	prosthesis and residual limb care	community and employment adjustments with prosthesis	independent exercise and pursuit of recreational activities

PART I
Progressive Balance, Agility, and Coordination Exercises.

Balance - the ability to maintain the center of gravity (COG) over a base of support (BOS) while maintaining equilibrium.

Proprioception - the ability to receive information concerning movement and/or changes in movement within the body. Stimuli is received within tissues of the body such as muscle, tendon and joint.

Kinesthesia - the awareness of joint movements, postural changes and forces acting on the body in relationship to space.

Coordination - the working harmony of all movements necessary to perform a specific task or functional activity quickly, smoothly, and efficiently.

Agility - the ability to move quickly and easily with speed and coordination.

Balance, proprioception, coordination, and agility are the result of the integration of neurophysiological and musculoskeletal functions based on a multitude of sensory inputs which in turn promote the desired motor response in a dynamic environment. The natural neurodevelopmental sequence of life provides an instinctive progression of learned skills that permits humans to utilize these critical functions throughout the life span. Barring any motor or sensory interruption, humans have the ability to adapt to the environment and develop balance, proprioception, coordination, and agility to the level of their personal capabilities. However, in the event of a physical catastrophe where the harmony of these integrated skills is disrupted, major adaptations, and a re-education of previously learned neuromuscular patterns must occur.

For an individual to master a particular skill by starting with the most difficult task is unlikely, and in most instances only promotes frustration. Therefore, the following program is based on the assumption that by providing the amputee with a learning environment which allows for basic balance skills to be learned prior to higher level coordination and agility skills requiring superior balance, the amputee will, in the long term, have far greater results.

Although many of the exercises appear similar by design, the motor patterning required for each level is significantly different. For example, to maintain one's center of gravity over a base of support in high kneeling versus long sitting requires additional trunk, hip musculature and joint control to develop the postural hip strategies required to maintain an upright posture. Add secondary skills such as trunk rotation with a wand, or a sequentially finer movement pattern such as cone placement and the amputee is now re-learning hip synergistic patterns or hip strategies that will compensate for the limb portion that has been lost. Additionally, the limits of COG displacement and weight shifting are becoming integrated into the movement patterns.

The aforementioned skills are the catalyst for all effortless movement. For amputees re-establishing the most basic of movement patterns, the chances for success in learning more complicated activities such as walking, rising from the floor, or ascending stairs will be greatly enhanced through the practice of the following exercises. Even young and agile amputees should take time to re-establish a sense of how to maintain their COG over their BOS in sitting, kneeling, and standing, with and without a prosthesis.

The following exercises are presented in a sequence that permits the amputee to progress from the most basic balance exercises to the more complex coordination and agility exercises. The following basic concepts should be kept in mind when deciding which exercises to prescribe:

1. Always sequence exercises from the most basic to the more complex, taking into account the motor and sensory requirements of each exercise. As in life, a series of small successes will be more likely to promote perseverance than one grand effort that fails.

2. Attempt to make each exercise challenging and fun. Constant repetition of a learned skill that provides little challenge may cause the amputee to become disinterested. Always try to add one more component to each exercise that will increase the level of difficulty and provide stimulation.

General Instructions

The patient should:

1. not feel any strain in attaining or maintaining a posture.

2. always move slowly and deliberately when first performing the exercises, progressing to more functional speeds when appropriate.

3. concentrate on the movement while observing what positional or postural alterations assisted in the successful completion of the exercise.

4. feel the shift of body weight over the base of support.

5. attempt the next level of difficulty once a exercise is mastered in one position.

Warning: Any exercise activities not approved by appropriate medical personnel can have harmful results. Prior to any exercise program, have your doctor or therapist assess your medical and physical status. All exercise programs should be prescribed by a board-certified and registered professional. If, at any time, sudden pain or discomfort lasting more than 24 hours should result, consult your doctor immediately.

1A. Independent Long Sitting Exercises

Note: The following 9 exercises may also be performed in short sitting which will challenge hip and trunk musculature differently.

1. Wand Trunk Rotation

Equipment: 3-5 foot wand or broomstick

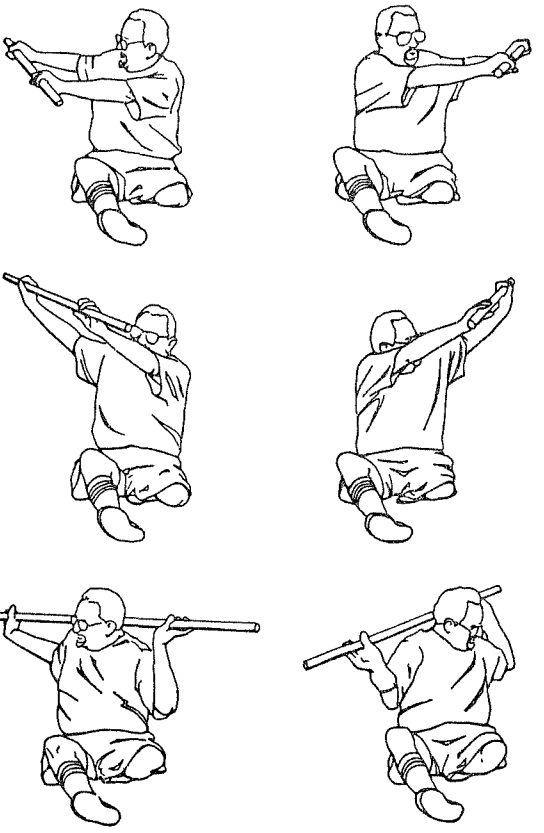
a. Patient sits on a firm resting surface with legs extended, or slightly bent to maintain sitting balance. Patient holds a wand in both hands with palms facing down.

b. Patient raises wand to shoulder height and rotates from side to side, keeping the pelvis stationary. Move slowly for a count of _____ seconds in each direction.

c. Repeat this movement for _____ repetitions.

d. Patient raises wand overhead, and/or places wand behind head and repeats the exercise for _____ repetitions.

e. Perform _____ sets.

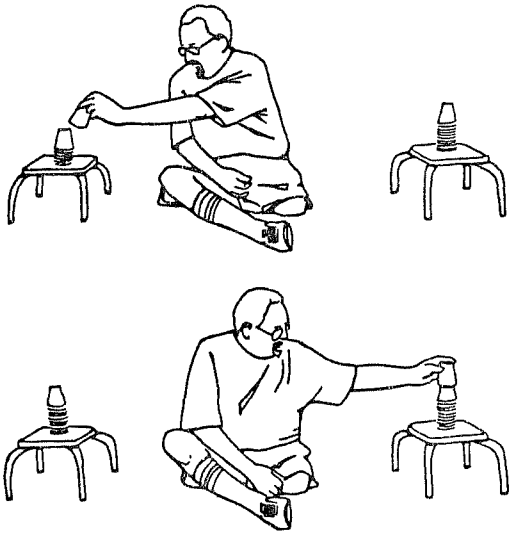


2. Placement Trunk Rotation

Equipment: stack of 5-10 cones or paper cups, and 2 footstools

a. Patient sits on a firm resting surface with legs extended, or slightly bent to maintain sitting balance. A stack of cones or cups is placed on footstools to either side of hips. Patient places inactive arm in lap.

b. Patient reaches across body and picks up one cone from the stack, and places it on the closer stack of cones.



c. Repeat this movement for _____ repetitions. Feel your weight shift from one hip to the other

d. Switch arms, and repeat the exercise for _____ repetitions.

e. Perform _____ sets.

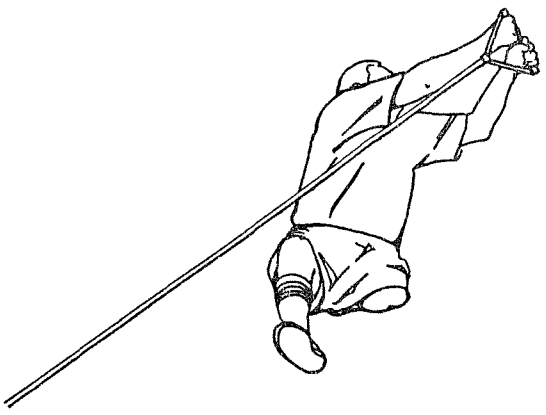
Variation: Increase the level of difficulty by 1) removing stools, 2) placing cones farther away, or 3) placing inactive arm behind back.

3. Resisted Diagonal Trunk Rotation

Equipment: 4 feet of rubber tubing

a. Patient sits on a firm resting surface, with legs extended, or slightly bent to maintain sitting balance. Patient grasps one end of the rubber tubing with both hands. The other is anchored to the leg of the mat table, or an immovable object.

b. Holding tubing firmly at the hip, patient reaches up and across body, over opposite shoulder, rotating from waist. Keep elbows and wrists as straight as possible. Patient's head should move with arms so that they are looking over their shoulder in the peak position. Return to starting position slowly.



c. Repeat this movement for _____ repetitions.

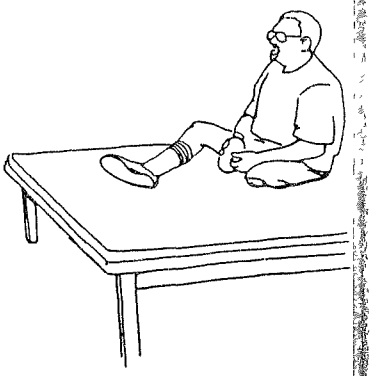
d. Switch direction and repeat the exercise for _____ repetitions. Tubing attachment will need to be altered.

e. Perform _____ sets.

1B. Assisted Long Sitting Exercises

4. Ball Throwing

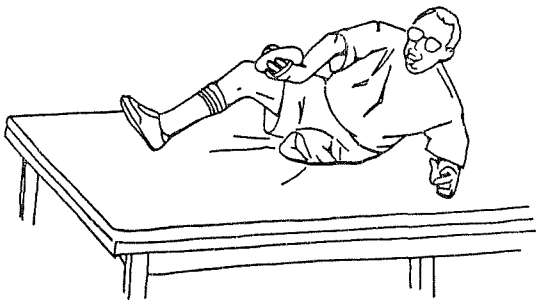
Equipment: tennis ball, Velcro ball and paddle, or any other lightweight ball



a. Patient sits on a firm resting surface, with legs comfortably apart and extended, or slightly bent to maintain sitting balance. Patient holds the ball in one hand.

b. Patient throws the ball either under-hand or over-hand (depending on ability) to therapist in front of them for _____ repetitions.

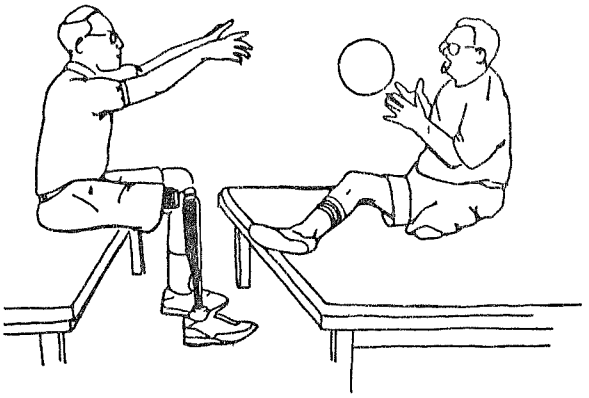
c. Patient catches the ball thrown by the therapist for _____ repetitions.



d. Patient throws the ball farther to the therapist, requiring greater strength and larger motions. The therapist tosses the ball farther away from the amputee, requiring greater mobility and agility to catch the ball, for _____ repetitions.

Variation: 1) Switch throwing arm, or 2) Patient throws and catches the ball with another patient seated on mat or standing, with therapist guarding.

5. **Plyoball Throws**



Equipment: medicine ball or plyoball

a. Patient sits on a firm resting surface, with legs comfortably apart and extended, or slightly bent to maintain sitting balance. Patient holds the ball with both hands.

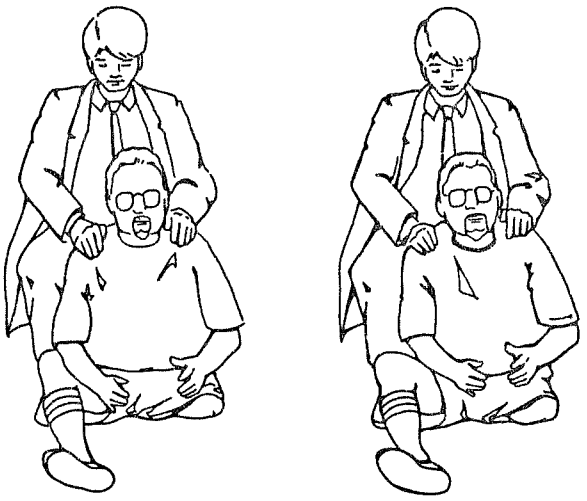
b. Chest Pass: Patient raises ball to chest height and throws to therapist in front of them for _____ repetitions.

c. Overhead Pass: Patient raises ball overhead and throws to therapist in front of them for _____ repetitions.

d. Rotational Pass: Patient raises ball to chest height or overhead, and throws to therapist standing diagonally to the left or right of them for _____ repetitions.

Variation: Patient throws and catches ball with another patient seated on mat or standing, with therapist guarding.

6. **Manually Resisted Trunk Flexion**



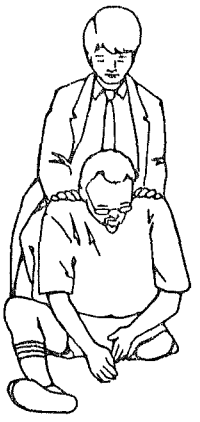
a. Patient sits on a firm resting surface with legs comfortably apart and extended, or slightly bent to maintain sitting balance.

b. Therapist places hands on anterior surface of both shoulder joints, gently pulling patient into trunk extension. Patient resists movement by flexing trunk.

c. Therapist/patient repeat the exercise for _____ repetitions.

Variation: Therapist varies the amount of resistance given to trunk flexion.

7. **Manually Resisted Trunk Extension**



a. Patient sits on a firm resting surface with legs comfortably apart and extended, or slightly bent to maintain sitting balance.

b. Therapist places hands on posterior surface of both shoulder joints, gently pushing patient into trunk flexion. Patient resists movement by extending trunk.

c. Therapist/patient repeat the exercise for _____ repetitions.

Variation: Therapist varies the amount of resistance given to trunk extension.

8. **Manually Challenged Balance**

a. Patient sits on a firm resting surface with legs comfortably apart and extended, or slightly bent to maintain sitting balance.

b. Therapist alternately places hands on posterior and anterior surfaces of shoulder joints, gently pushing patient into trunk flexion, extension, or rotation. Patient resists movement by opposing the resistance given with necessary musculature.

c. Therapist/patient repeat the exercise for _____ repetitions.

Variation: Therapist varies hand placement, the amount of resistance given, and the speed of hand placement change.

9. Resisted Chopping Pattern

a. Patient sits on a firm resting surface with legs comfortably apart and extended, or slightly bent to maintain sitting balance.

b. Patient clasps hands together with elbows extended. Therapist places one hand over the patient's hands and the other hand over the anteriolateral aspect of the head.

Upward Diagonal

d. The therapist passively places the patient's upper extremities, trunk, and head in a downward rotated position, opposite to the desired finished position. The patient raises both upper extremities in a diagonal motion across the body, over the opposite shoulder with the head and trunk rotating simultaneously up and towards the therapist. Resistance is applied appropriately by the therapist.

Command: "Push your head and arms up and back toward me."

Downward Diagonal

e. The therapist places one hand under the patient's hands and the other on the opposite anteriolateral side of the head. The therapist resists the patient's movement as the upper extremities, trunk and head are simultaneously rotated down and diagonally across the body from the upward to downward position.

Command: "Pull your head and arms down and across your body."

f. Therapist/patient repeat the exercise for _____ repetitions. Therapist repeats exercise on the opposite side.

2A. Independent Quadruped Exercises

Equipment: above- and bilateral below-knee amputees may need to have a bolster positioned under their trunk for support

1. Unilateral Upper Extremity Raise

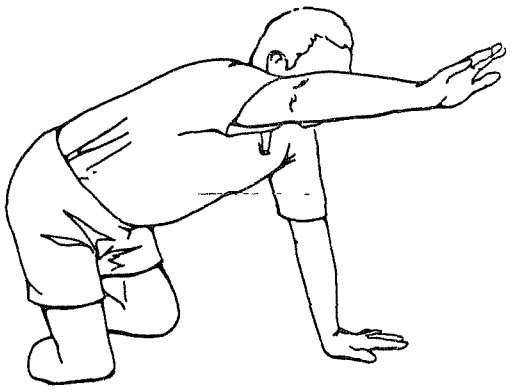
a. Patient kneels on their hands and knees in the center of the mat table.

b. Patient slowly raises one arm out in front of them until it is horizontal.

c. Hold the position for _____ seconds.

d. Patient slowly lowers the arm to the mat, and repeats the movement with the opposite arm, holding the position for _____ seconds.

e. Perform _____ repetitions for each arm and perform _____ sets.



2. Unilateral Lower Extremity Raise

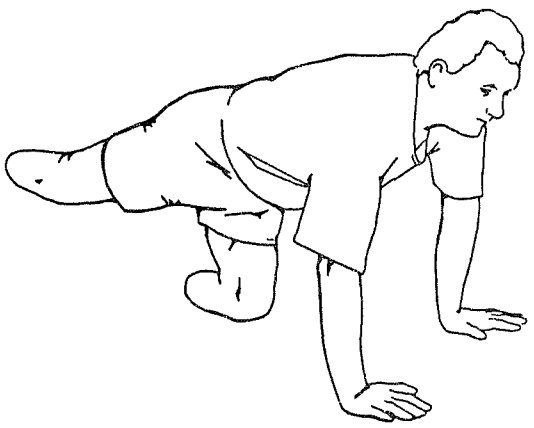
a. Patient kneels on their hands and knees in the center of the mat table.

b. Patient slowly raises one leg out in back of them until it is horizontal.

c. Hold the position for _____ seconds.

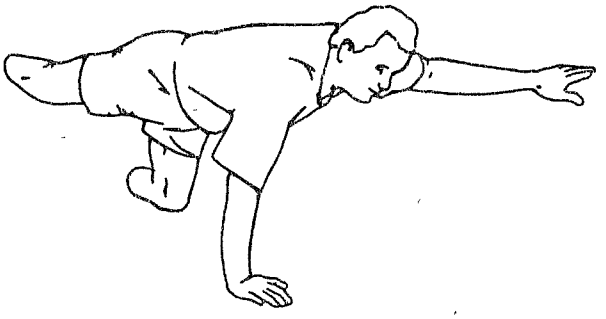
d. Patient slowly lowers the leg, and repeats the movement with the opposite leg, holding the position for _____ seconds.

e. Perform _____ repetitions for each leg and perform _____ sets.



3. Diagonal Upper/Lower Extremity Raise

a. Patient kneels on their hands and knees in the center of the mat table.



b. Patient simultaneously raises one leg out in back of them, as well as the opposite arm out in front of them until they are both horizontal.

c. Hold the position for _____ seconds.

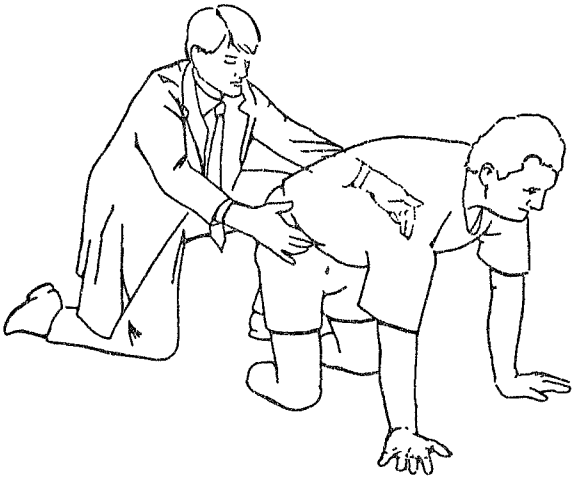
d. Patient slowly lowers the leg and arm, and repeats the movement with the opposite leg and arm, holding the position for _____ seconds.

e. Perform _____ repetitions for each leg/arm combination and perform _____ sets.

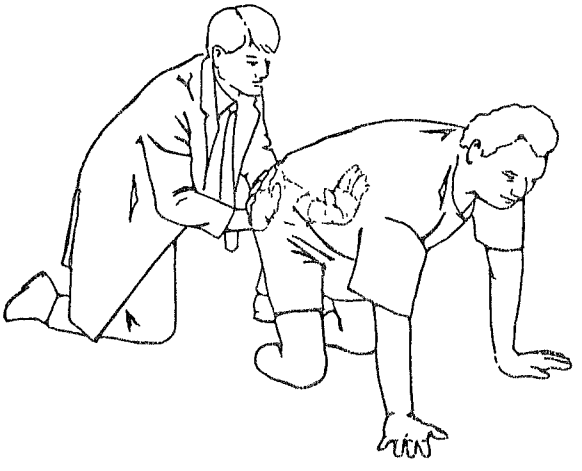
2B. Assisted Quadruped Exercises

4. Resisted Quadruped Balance

a. Position patient on their hands and knees in the center of the mat table. Place a bolster under patient's trunk for support as necessary.



b. Therapist alternately places hands on posterior and anterior surfaces of shoulder joints, as well as alternately on anterior superior iliac spines and ischial tuberosities, gently challenging patient's stability in the quadruped position. Patient responds by contracting necessary musculature to maintain position.



c. Therapist/patient repeat the exercise for _____ repetitions.

Variation: Therapist varies hand placement, the amount of force applied, and the speed of hand placement change.

5. Resisted Lower Extremity Raise

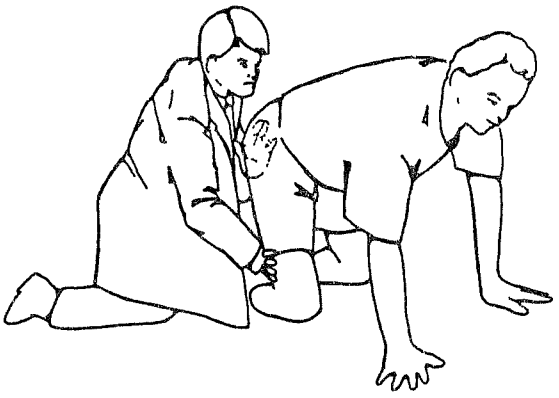
a. Position patient on their hands and knees in the center of the mat table. Place a bolster under patient's trunk for support as necessary.

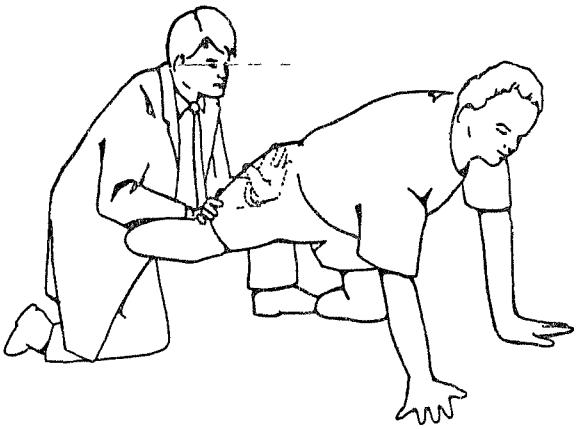
b. As the patient slowly raises the residual limb toward horizontal, therapist applies resistance to this movement with hand placements on the ischial tuberosity and posterior thigh.

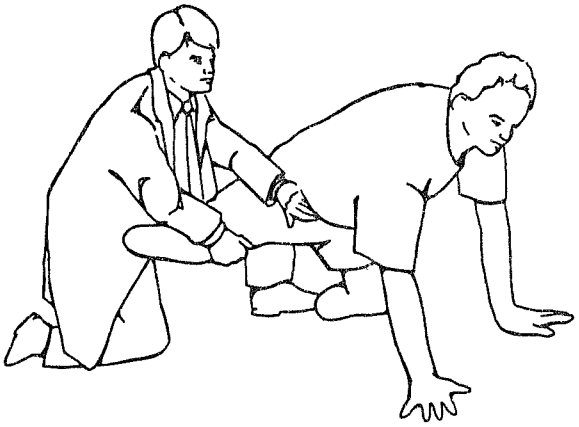
c. Once patient has attained the horizontal plane, therapist changes hand positions to the anterior superior iliac spine and the anterior thigh, and instructs the patient to return to starting position, providing resistance.

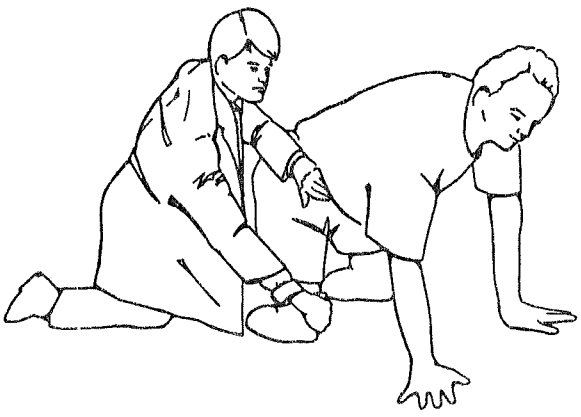
d. Therapist should perform this exercise bilaterally for below-knee amputees.

e. Perform _____ repetitions for each leg.





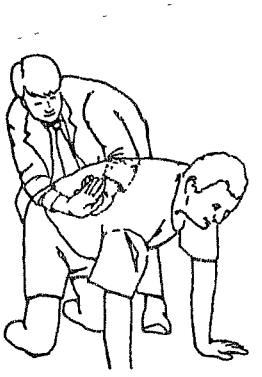




6. Diagonal Weight Shifting

a. Position patient on their hands and knees in the center of the mat table. Place a bolster under patient's trunk for support as necessary.

b. Therapist cups hands over one ischial tuberosity and instructs patient to "sit back into my hands", providing appropriate resistance.



c. Therapist switches hand placements to cup opposite anteriolateral shoulder and instructs patient, "pull up into my hands", providing appropriate resistance.

d. Perform _____ repetitions, alternating hand placement.

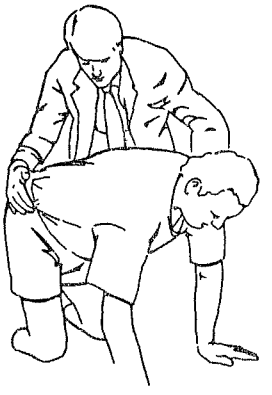
e. Therapist performs exercise to opposite ischial tuberosity and contralateral shoulder for _____ repetitions, alternating hand placement.

7. Resisted Trunk Rotation

a. Position patient on their hands and knees in the center of the mat table. Place a bolster under patient's trunk for support as necessary.

b. Therapist places proximal hand over anteriolateral surface of one shoulder joint. The distal hand is placed under the contralateral ischial tuberosity. Therapist instructs patient to "twist into my hands", providing appropriate resistance.

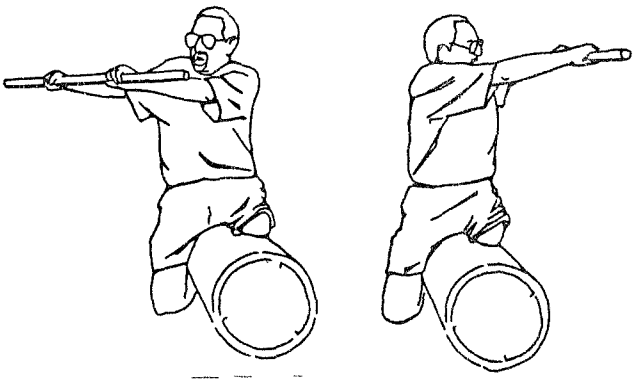
c. Therapist switches hand placements to opposite shoulder and contralateral ischial tuberosity as above, and again instructs patient to "twist into my hands".



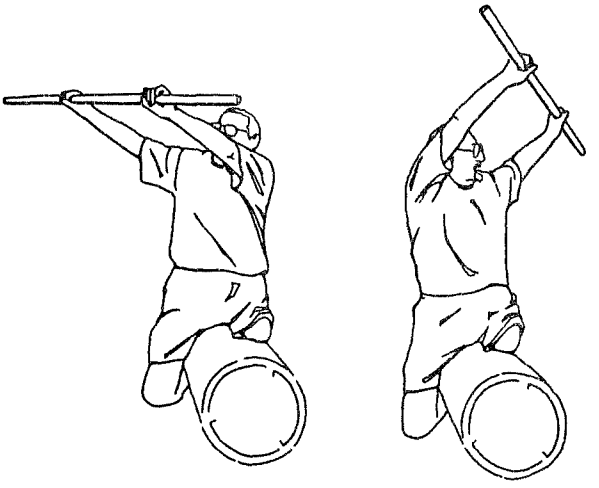
d Therapist alternates above hand placements for _____ repetitions.

3A. Independent High Kneeling Exercises

Note: For the following 9 high kneeling exercises the recommended position on the bolster for the amputee are:



Above-knee amputee: Kneels on sound limb, with residual limb supported on bolster positioned horizontally beneath them.
Below knee-amputee: Kneels on both knees.
Bilateral below-knee amputee: Kneels on both knees, straddling a bolster placed horizontally beneath them.

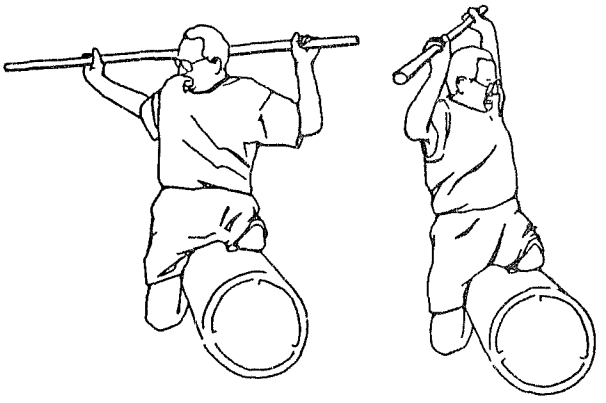


1. **Wand Trunk Rotation**

   Equipment: medium round bolster, 3-5 foot wand or broomstick

a. Patient grasps wand with both hands, palms facing down.

b. Patient raises wand to shoulder height, and rotates from side to side, keeping pelvis stationary. Move slowly for a count of _____ seconds in each direction.

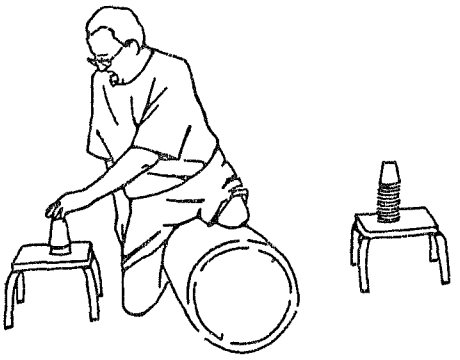


c. Repeat this movement for _____ repetitions.

d. Patient raises wand overhead, and/or behind head, and repeats the exercise for _____ repetitions.

e. Perform _____ sets.

2. Placement Trunk Rotation

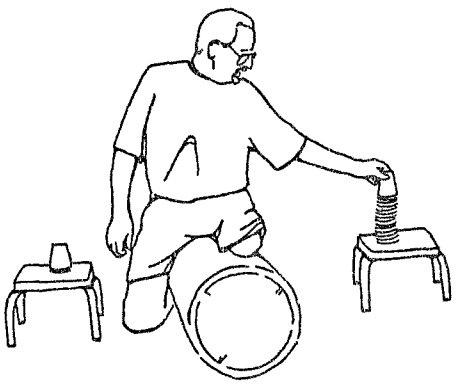


Equipment: medium round bolster, stack of 5-6 cones or paper cups, and 2 footstools

a. A stack of cones is placed on footstools to either side of patient's hips.

b. Patient reaches across body and picks up one cone from beside opposite hip, and brings it back to the closer stack of cones.

c. Repeat this movement for _____ repetitions. Feel your weight shift from one hip to the other.



d. Switch arms, and repeat the exercise for _____ repetitions.

e. Perform _____ sets.

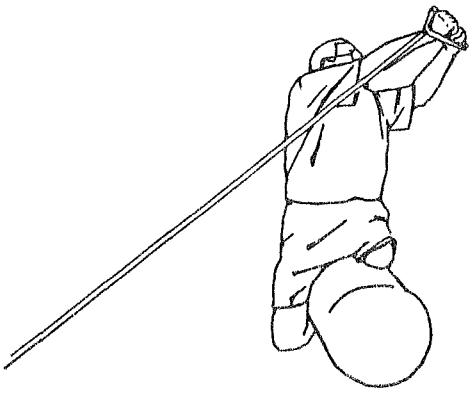
Variation: Increase the level of difficulty by 1) removing stools, 2) placing cones farther away, or 3) placing inactive arm behind back.

3. Resisted Diagonal Trunk Rotation

Equipment: medium round bolster, 4 feet of tubing

a. Patient grasps one end of tubing with both hands. The other end is anchored to the leg of the mat table or an immovable object.

b. Holding tubing firmly at the hip, patient reaches up and across body, over opposite shoulder, rotating from waist. Keep elbows and wrists as straight as possible. Patient's head should move with arms so that they are looking over their shoulder in the peak position. Return to starting position slowly.



c. Repeat this movement for _____ repetitions.

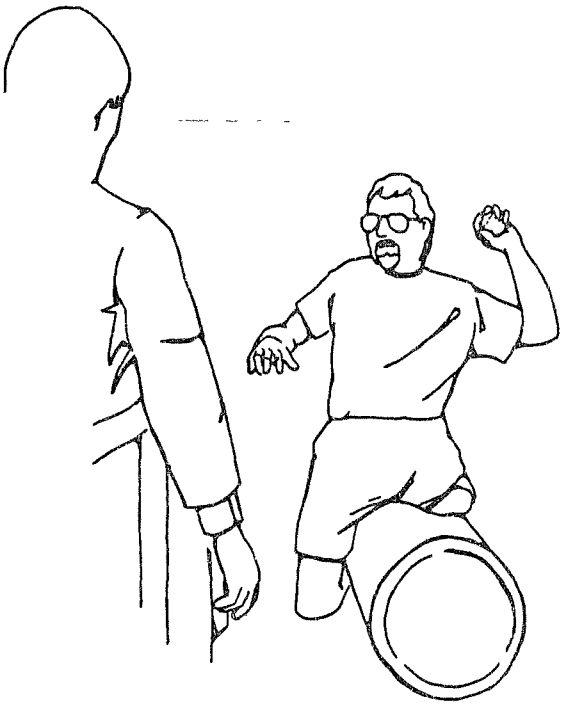
d. Switch direction and repeat the exercise for _____ repetitions. Tubing attachment will need to be altered.

e. Perform _____ sets.

3B. Assisted High Kneeling Exercises

4. Ball Throwing

Equipment: tennis ball, Velcro ball and paddle or any other lightweight ball



a. Patient holds the ball in one hand.

b. Patient throws the ball either under hand or over hand (depending on ability) to therapist in front of them for _____ repetitions.

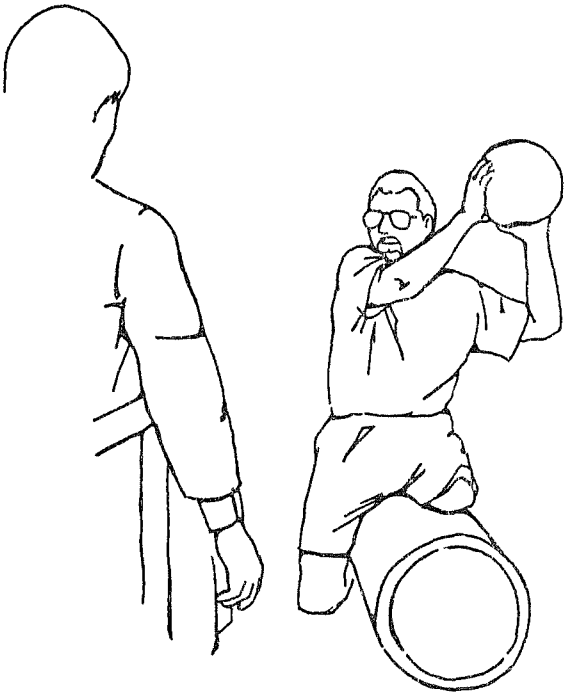
c. Patient catches the ball thrown by the therapist for _____ repetitions.

d. Patient throws the ball farther to the therapist, requiring greater strength and larger motions. The therapist tosses the ball farther away from the amputee, requiring greater mobility and agility to catch the ball, for _____ repetitions.

Variation: 1)Switch throwing arm, or
2) Patient throws and catches the ball with another patient seated on mat or standing, with therapist guarding.

5. **Plyoball Throws**

Equipment: medium round bolster, medicine ball or plyoball



a. Patient holds ball with both hands.

b. Chest Pass: Patient raises ball to chest height and throws to therapist in front of them for _____ repetitions.

c. Overhead Pass: Patient raises ball overhead and throws to therapist in front of them for _____ repetitions.

d. Rotational Pass: Patient raises ball to chest height or overhead, and throws to therapist standing diagonally to the left or right of them for _____ repetitions.

Variation: Patient throws and catches ball with another patient seated on mat or standing, with therapist guarding.

6. **Manually Resisted Trunk Flexion**

a. Therapist places hands on anterior surface of both shoulder joints, gently pulling patient into trunk extension. Patient resists movement by flexing trunk.

b. Therapist/patient repeat the exercise for _____ repetitions.

Variation: Therapist varies the amount of resistance given to trunk flexion.

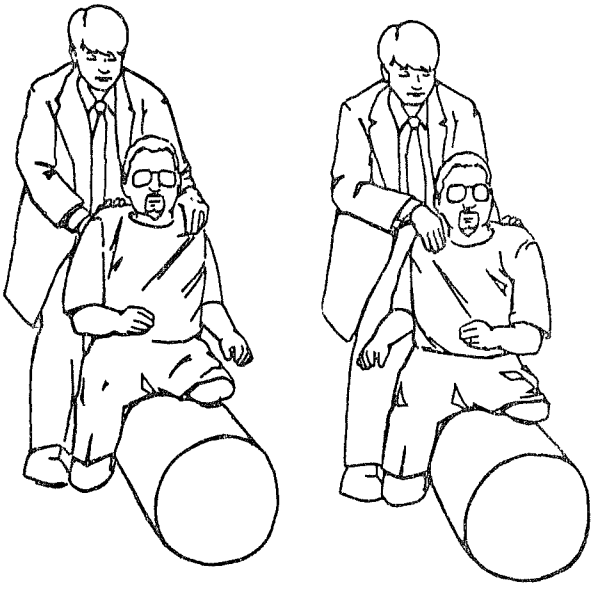
7. Manually Resisted Trunk Extension

a. Therapist places hands on posterior surface of both shoulder joints, gently pushing patient into trunk flexion. Patient resists movement by extending trunk.

b. Therapist/patient repeat the exercise for _____ repetitions.

Variation: Therapist varies the amount of resistance given to trunk extension.

8. Manually Challenged Balance



a. Therapist alternately places hands on posterior and anterior surfaces of shoulder joints, gently pushing patient into trunk flexion, extension, or rotation. Patient resists movement by opposing the resistance given with necessary musculature.

b. Therapist/patient repeat the exercise for _____ repetitions.

Variation: Therapist varies hand placement, the amount of resistance given, and the speed of hand placement change.

9. Resisted Chopping Pattern

a. Patient clasps hands together with elbows extended. Therapist places one hand over patient's hands and other hand over anteriolateral aspect of head.

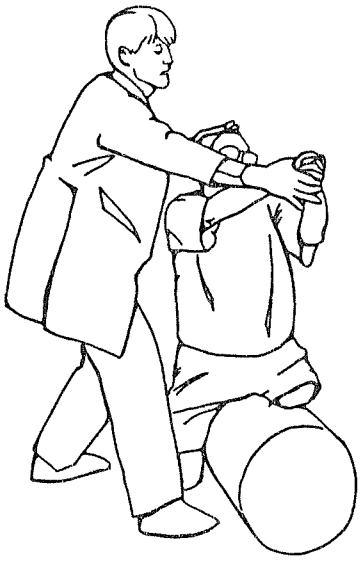
Upward Diagonal

b. Therapist passively places patient's upper extremities, trunk, and head in a downward rotated position, opposite to desired finished position. The patient raises both upper extremities in a diagonal motion across the body, over opposite shoulder with head and trunk rotating simultaneously up and towards the therapist. Resistance is applied appropriately by therapist.

Command: "Push your head and arms up and back toward me."

Downward Diagonal

c. Therapist places one hand under patient's hands and the other on opposite anteriolateral side of head. Therapist resists patient's movement as upper extremities, trunk and head are simultaneously rotated down and diagonally across body from upward to downward position.



Command: "Pull your head and arms down and across your body."

d. Therapist/patient repeat exercise for _____ repetitions Therapist repeats exercise on opposite side

4. Standing Exercises

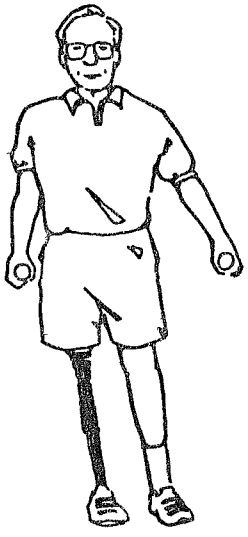
Note: The following 12 exercises may be practiced both with and without a prosthesis. Therapist is advised to select appropriate exercises for independent practice.

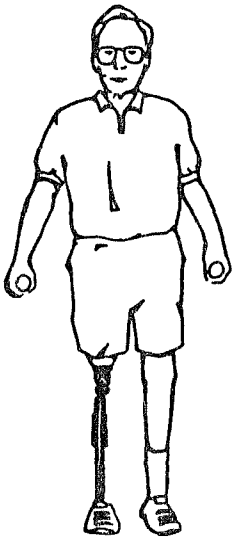
1. Standing Balance

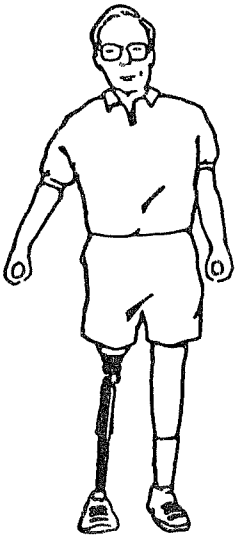
a. Patient stands in the parallel bars (P-Bars) facing a full length mirror, placing both hands on the P-Bars. The feet should be approximately 2-4 inches apart. This is the normal base of support (BOS) or distance between the feet.

Exercise 1 - Side-to-Side:

b. Patient shifts body weight from right to left. Patient should: 1) note how the pressure changes at the stump/socket interface with the change in weight-bearing; 2) become familiar with the movements throughout the lower extremities; and 3) work toward maintaining balance with use of the available musculature.





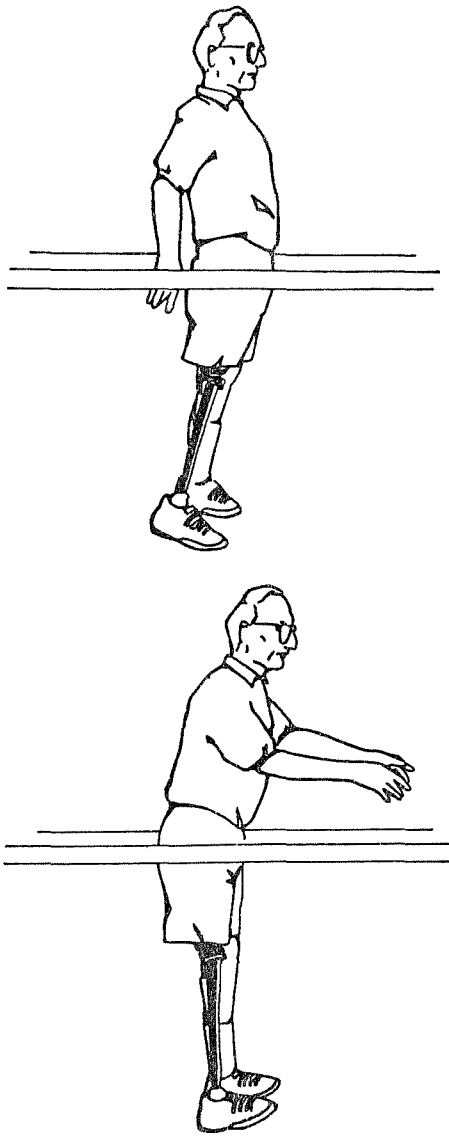


Exercise 2 - Forward and Backward:

b. Patient shifts body weight forward and backward, beginning with small movements, progressing slowly to movements of greater amplitude. Patient should continue to be aware of the pressure changes with the change in weight-bearing, and use their musculature as described above.

c. When this movement feels comfortable with both hands on the bars, patient removes the unaffected-side hand and continues the side-to-side, or forward-backward movement.

d. When patient feels comfortable using one hand for balance, both hands can be removed from the bars. Again, patient should feel the change in pressure at the stump/socket interface as the movement continues.



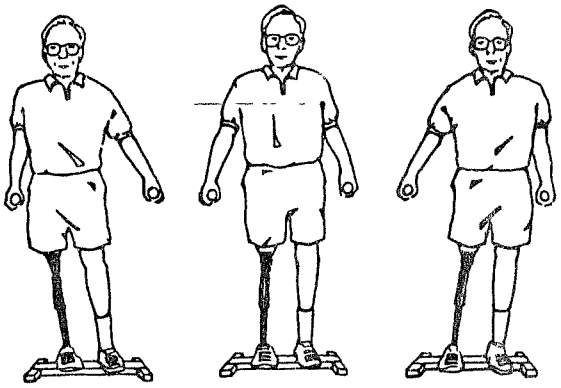
Balance recovery tips for the patient:

If the patient shifts their body weight too far forward (over the toes) simply have them stretch both arms back and arch their spine.
or
If the patient shifts their body weight too far backward (over the heels) simply have them raise both arms forward and bend forward at the hips.

2. Hip Strategy Balance On 2"x 4"

Equipment: a 2-4 foot long 2"x4" board with a one-foot piece of wood secured perpendicularly at either end for stability

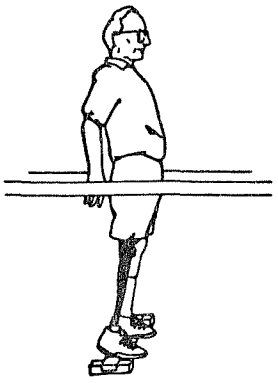
a. Patient stands in the P-Bars and steps onto the center of a 2"x4" board, holding onto the bars with both hands. Steady patient until they are able to maintain comfortable standing balance.



Exercise 1 - Side to Side:

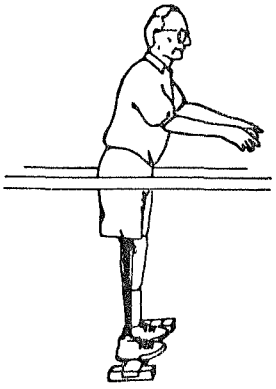
b. Patient shifts body weight from right to left. Patient should: 1) note how the pressure changes at the stump/socket interface with the change in weight-bearing; 2) become familiar with the movements at their hips; and 3) work toward maintaining balance with the use of hip musculature.

Exercise 2 - Forward and Backward:



b. Patient shifts body weight forward and backward, beginning with small movements, progressing slowly to movements of greater amplitude. Patient should continue to be aware of the pressure change with the change in weight-bearing, and use their hip musculature as described above.

c. When this movement feels comfortable with both hands on the bars, patient removes the unaffected-side hand and continues the side-to-side, or forward-backward movement.



d. When patient feels comfortable using one hand for balance,both hands should be removed from the bars. Again, patient should feel the change in pressure at the stump/socket interface as the movement continues.

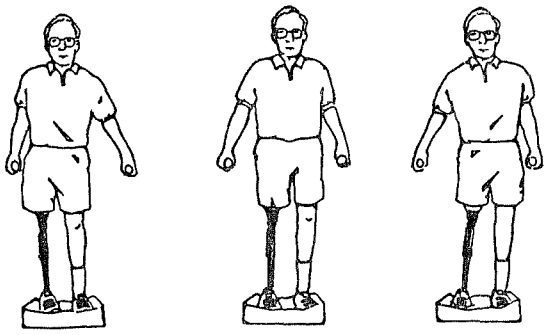
3. Compliant Surface Balance

Equipment: a 1-4 inch thick piece of foam rubber, approximately 2 ft x 2 ft

a. Patient stands in the P-Bars with both hands on the bars. Patient steps onto the center of the foam rubber. Steady patient until they are able to maintain comfortable standing balance.

Exercise 1 - Side-to-Side:

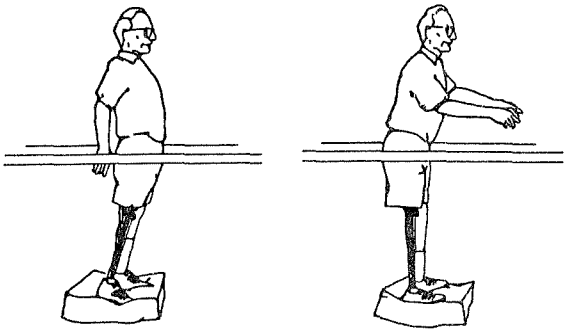
b. Patient shifts body weight from right to left. Patient should: 1) note how the pressure changes at the stump/socket interface with the change in weight-bearing; 2) become familiar with the movements at their hips; and 3) work toward maintaining balance with use of hip musculature.



Exercise 2 - Forward and Backward:

b. Patient shifts body weight forward and backward, beginning with small movements, progressing slowly to movements of greater amplitude. Patient should continue to be aware of the pressure changes with the change in weight-bearing, and use their hip musculature as described above.

c. When this movement feels comfortable with both hands on the bars, patient removes the unaffected-side hand and continues the side-to-side, or forward-backward movement.



d. When patient feels comfortable using one hand for balance, both hands can be removed from the bars. Again, patient should feel the change in pressure at the stump/socket interface as the movement continues.

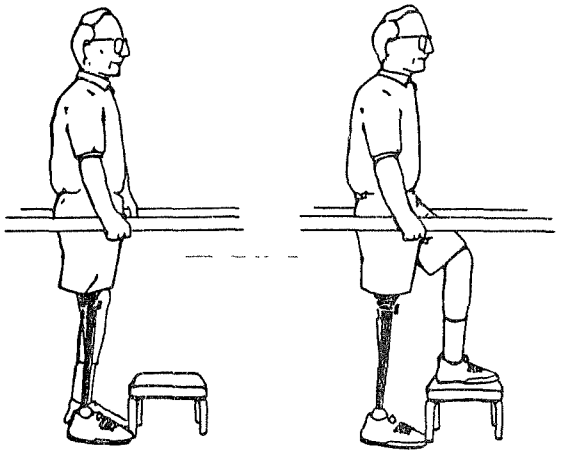
4. Stool Stepping:

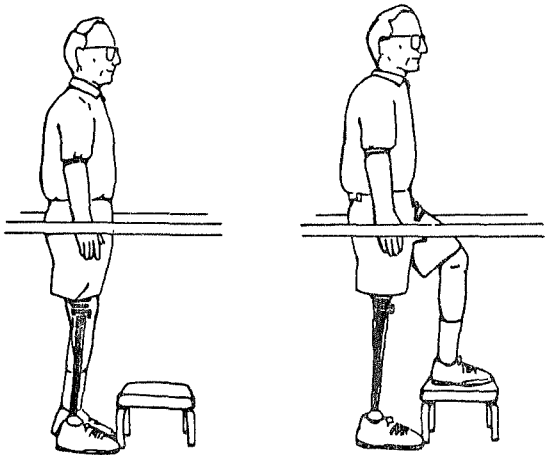
Equipment: 7-9 inch stool, parallel bars

a. Patient stands in the P-Bars with both hands on the bars and their feet comfortably apart (2-4 inches). Place a 7-9 inch step stool in front of the unaffected leg.

b. With both hands on the bars, patient steps onto the stool with the unaffected leg as slowly as possible. Patient repeats this movement several times until comfortable with it.

c. When patient is comfortable with this movement, the unaffected-side hand should be removed from the bar. Again, patient slowly steps onto the stool with the unaffected leg. Once patient can perform this movement slowly, remove both hands from the bars, and continue stepping onto the stool in a slow and controlled manner.





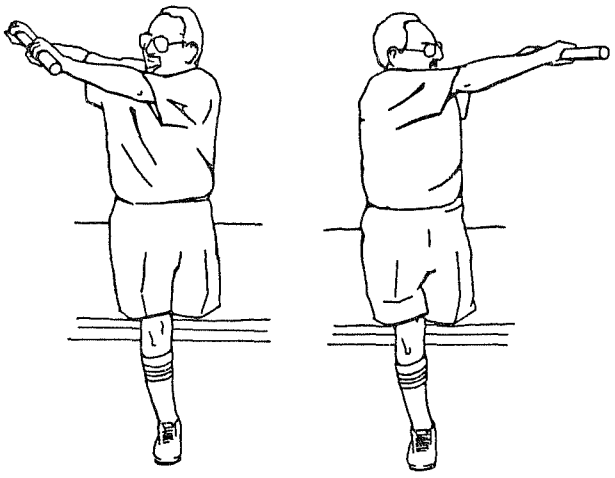
Note: Most individuals will experience difficulty in stepping with the unaffected leg in a slow controlled manner, as well as in maintaining their balance over the prosthesis during this exercise. This is largely due to the lack of strength, balance and coordination in the hip of the residual limb. Concentration should be placed on controlling the prosthetic limb, rather than simply moving the unaffected limb slowly. Concentration should be focused on the following three items when stepping up:

1) Muscular control of the hip on the prosthetic side.

2) Control of the prosthesis with the distal end of the residual limb.

3) Visualizing control of the movement of the prosthetic ankle/foot assembly.

5. **Wand Trunk Rotation**



Equipment: 3-5 foot wand or broomstick

a. Patient stands in front of a mat table for safety or free-stands with therapist guarding. Patient grasps wand with both hands, palms facing down.

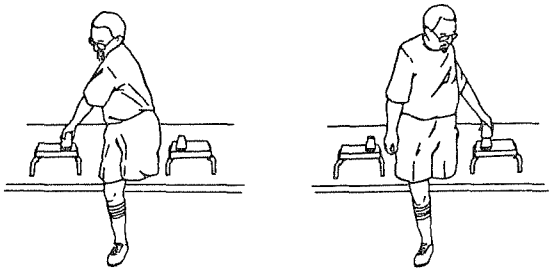
b. Patient raises wand to shoulder height, and rotates from side to side, keeping the pelvis stationary. Move slowly for a count of _____ seconds in each direction.

c. Repeat this movement for _____ repetitions.

d. Patient raises wand overhead, and/or behind the head, and repeats the exercise for _____ repetitions.

e. Perform _____ sets.

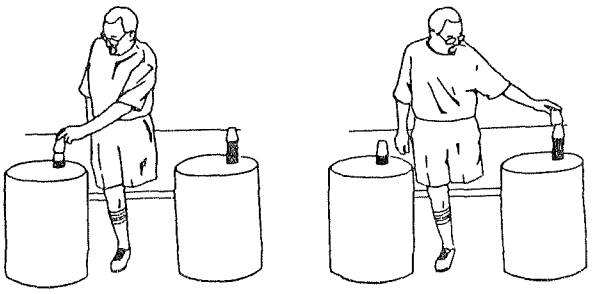
6. **Placement Trunk Rotation**



Equipment: stack of 5-6 cones or paper cups, 2 bolsters or foot stools

a. Patient stands in front of a mat table for safety or free-stands with therapist guarding. A stack of cones is placed to either side of patient's hips on bolsters or stools.

b. Patient reaches across body and picks up one cone from beside opposite hip, and brings it back to the other stack of cones.



c. Repeat this movement for _____ repetitions.

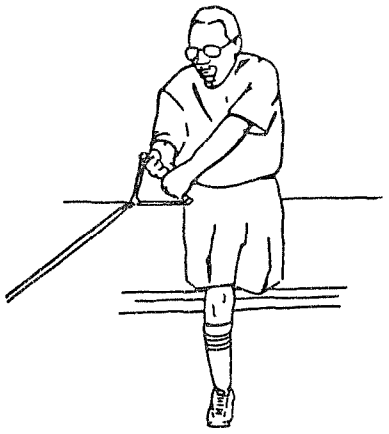
d. Switch arms, and repeat for _____ repetitions.

e. Perform _____ sets.

Variation: 1) Place inactive arm behind patient's back for greater difficulty, or 2) move cones farther away.

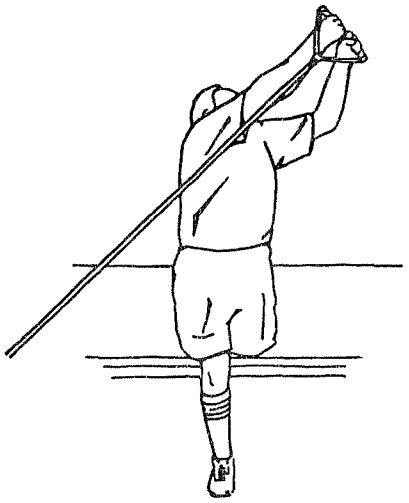
7. Resisted Diagonal Trunk Rotation

Equipment: 4 feet of tubing



a. Patient stands in front of a mat table for safety or free-stands with therapist guarding. Patient grasps one end of rubber tubing with both hands. The other end is anchored to the leg of the mat table, or an immovable object.

b. Holding tubing firmly at the hip, patient reaches up and across body, over opposite shoulder, rotating from waist. Elbows and wrists should be kept straight as possible. Patient's head should move with arms so that they are looking over their shoulder in the peak position. Return to starting position slowly.

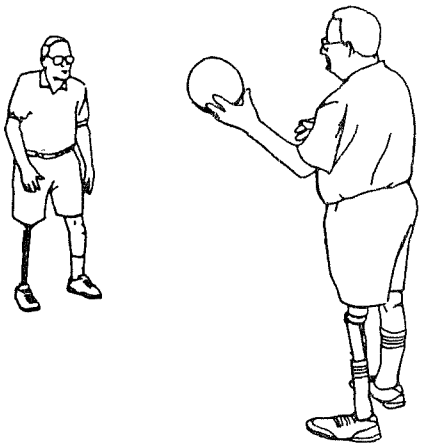


c. Repeat this movement for _____ repetitions.

d. Switch direction and repeat the exercise for _____ repetitions. Tubing attachment will need to be altered.

e. Perform _____ sets.

8. **Ball Throwing**



Equipment: tennis ball, Velcro ball and paddle or any other lightweight ball

a. Patient stands in front of a mat table for safety or free-stands with therapist guarding. Patient holds the ball in one hand.

b. Patient throws the ball either under hand or over hand (depending on ability) to therapist in front of them for _____ repetitions.

c. Patient catches the ball thrown by the therapist for _____ repetitions.

d. Patient throws the ball farther to the therapist, taking a step with the leg opposite to the throwing arm, requiring greater balance and coordination. The therapist tosses the ball farther away from the amputee's COG, requiring greater mobility and agility to catch the ball, for _____ repetitions.

Variation: 1) Switch throwing arm, or 2) Patient throws and catches the ball with another patient seated on mat or standing, with therapist guarding.