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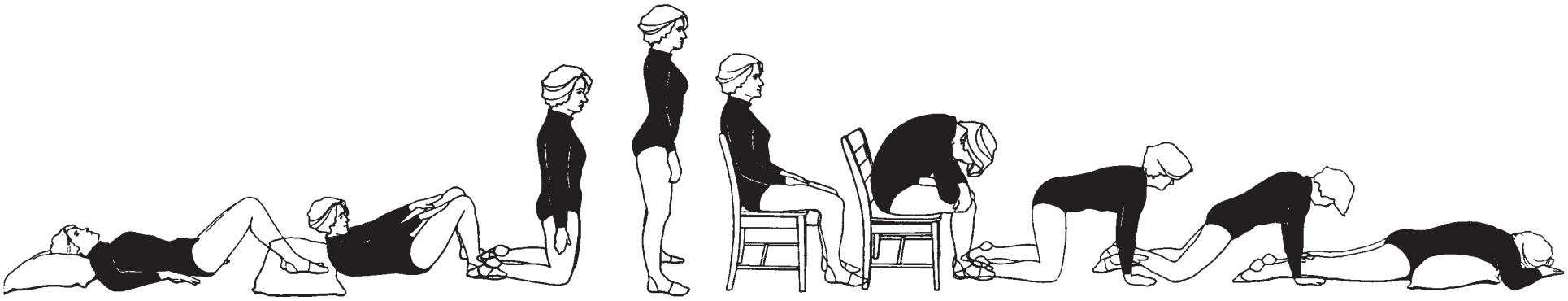
Mitochondrial Myopathy

An Exercise Guide



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Intent of this Booklet

The general intent of this booklet is to:

1. Provide information which can help you cope with Mitochondrial Myopathy.

2. Increase your understanding of some of the problems you may experience with Mitochondrial Myopathy.

2. Discuss the role of exercise in the physical management of Mitochondrial Myopathy.

3. Provide guidelines for exercising, walking and maintaining a good posture.

This booklet contains a suggested exercise programme. You are advised to do only those exercises taught to you by a Physiotherapist.

What is Mitochondrial Myopathy?

Mitochondrial myopathy is a group of genetic diseases caused by defects in the way that mitochondria, or powerhouses in the cells, make energy for the body. The disorders affect the organs and tissues that use the most mitochondrial energy, such as the muscles, eyes, ears and central nervous system. Symptoms of mitochondrial myopathy correspond to the areas of the body where the mitochondria are most affected. Some of these symptoms are:

- muscle cramping
- movement problems
- seizures
- heart disease
- muscle disease
- diabetes
- fatigue

It is important to note that all of these symptoms do not affect everyone; they vary widely among individuals.

Since the course and manifestations of the disease are so variable, treatment is geared to the individual. Staying active is important to managing mitochondrial myopathy. Although you can not cure mitochondrial disease by exercising, you **can** play an active part in management of your own symptoms.

This booklet provides a guide for maximizing your physical health and well-being.

Fatigue

Fatigue is a frequent concern of the person with mitochondrial myopathy. It may restrict your ability to perform your daily activities, cope with your job, family, etc. It is therefore important to find a balance between exercise, rest and other commitments.

Normal Muscle Fatigue may be expected when you exercise. It is natural to feel tired afterwards.

Fatigue Related to Psychological Problems such as lack of motivation, feelings of depression and anxiety may occur. It is a vicious cycle: the less you do, the less you feel like doing, and the more lethargic you become. Regular exercise can have a very positive effect in helping you overcome this particular form of fatigue.

Muscle fatigue from lack of energy, or "powering out", best describes the type of fatigue many people with mitochondrial myopathies experience. With this form of fatigue, you may experience cramping, muscle weakness, heaviness of the limb(s), tremor and lack of coordination. Repeated use of the affected limb may make you feel weak. This form of fatigue should not be confused with laziness; it cannot be overcome by effort. Do not push yourself.

Try to balance your activities with rest periods and employ energy conservation techniques (under the direction of an Occupational Therapist).

Why Exercise?

Exercise has been shown to improve functional capacity in patients with mitochondrial disease. Although exercise does not provide a cure for mitochondrial disease, it can greatly improve quality of life and prevent complications from developing.

Exercise can:

- *improve* energy production in the body
- *improve* ability to walk
- *reduce* lactate production
- *prevent* problems arising from inactivity and disuse. Inactivity can lead to a loss of motivation, energy and mobility, all of which may reduce independence.

Exercise is also important in reducing the risk of developing some complications which occur most frequently in people with mitochondrial disease such as diabetes and heart problems.

You may ask, "How can I exercise when I feel so lousy?" The key is to do it smartly and to know your limits. People with mitochondrial myopathies have often had bad experiences with exercise because they have over-exercised and felt worse as a result. Now, our understanding and experience shows that exercise can and should be part of one's life provided fatigue and the demands of daily living are taken into account. Research has shown that exercise actually *improves* energy production in the body.

Exercise plays an important role in maximizing physical health and mitochondrial function and can act as a valuable release of stress or tension in many people. A carefully tailored exercise programme can provide the same benefits for people with mitochondrial myopathy.

How to Exercise

1. **Schedule a time** for exercise and do it regularly.

2. **Take a dip** first if possible. A warm bath or shower relaxes muscles, increase circulation and can make exercise feel easier.

3. **Eat something** before you exercise to give your body energy. Do not exercise on an empty stomach. A good choice is to drink 250-375 mLs of fruit juice or a sport drink (such as Gatorade®) starting the hour before you exercise and continuing during exercise.

4. Stay hydrated. **Drink lots of water** during exercise and throughout the day. A good way to determine if you are getting enough water is if your urine is clear. If it is bright yellow, you need to drink more water.

5. **Break it up.** For instance, try gentle walking for 5 minutes, three times a day, and build from there.

6. **Stretch less.** Stretching promotes circulation and maintains your range of motion. However, do *shorter* stretches, holding 5 to 10 seconds, so you don't stress your muscles and expend a great deal of energy.

7. **Aim low at the beginning** and work up to it. Start very low in intensity and gradually increase. For example, if all you can do is one minute of exercise before you need to stop, start with that one minute and build gradually from there. Any exercise is better than no exercise.

8. **Stop if you experience nausea or if you vomit.** Decrease the intensity and/or duration for the next time you exercise.

9. **Do not perform any exercise which causes you pain.** However, it is natural to feel some temporary muscle aches or discomfort at the start of any form of new exercise.

10. **If fatigue is a factor**, modifications may need to be made, i.e. rest after the activity so that all of the benefits are retained without an increase in fatigue.

11. **Rest** at least 48 hours between exercise for strength (e.g. using weights) and at least 48 hours between endurance exercise sessions (e.g. stationary bicycle or walking program).

12. **Do not hold your breath** while exercising. All movements should be performed slowly, smoothly and with control.

13. It is important to be guided by a **Physiotherapist**.

14. Remember that an increase in exercise tolerance is not achieved quickly. **It will take time, consistency, and motivation on your part.**

Posture

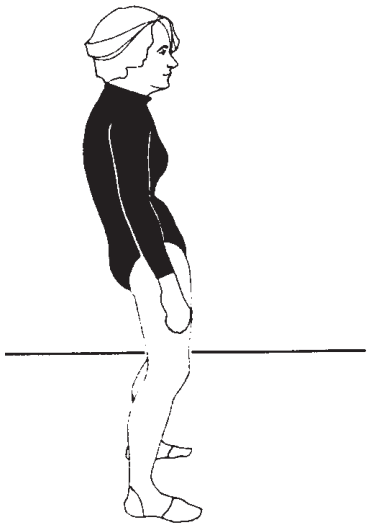

Figure A
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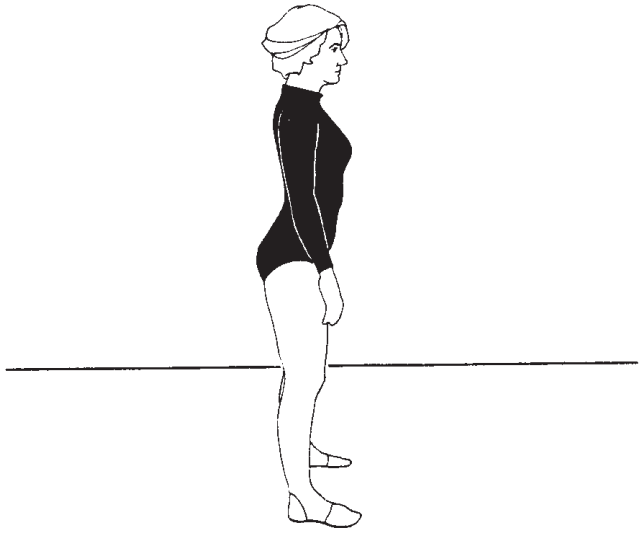

Figure B
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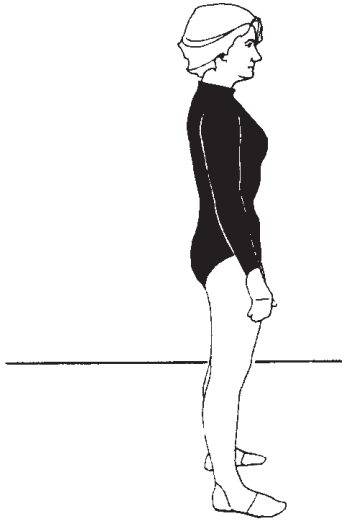


Figure C
good

Introduction

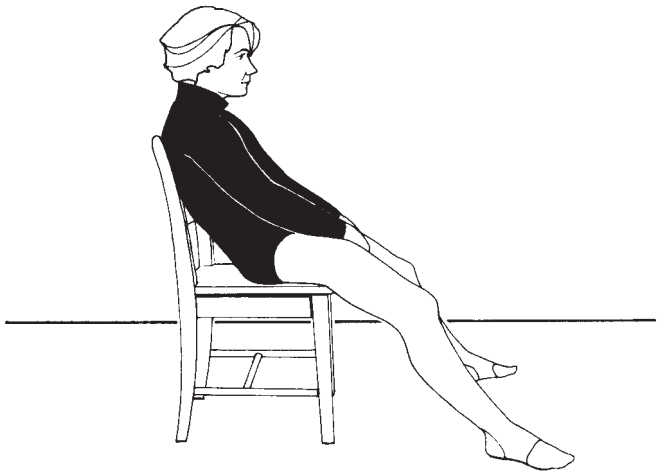
Postural problems are common in the general population as well as in patients with mitochondrial myopathy.

A Physiotherapist will assess your posture and make recommendations if correction is required.

Figures A and B are examples of *abnormal posture*, which, if uncorrected, may lead to other problems such as pain, impaired balance, and functional difficulties.

Figure C shows the *ideal posture*.

Checklist for Ideal Posture



A

Poor Posture

B

Ideal Posture

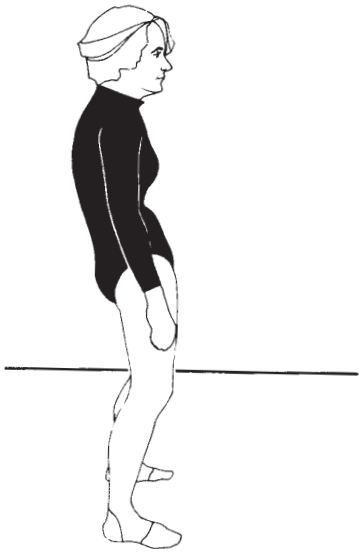
Sitting Position

Tuck your chin in comfortably; hold your head up and lengthen your neck.

Pull your shoulders slightly down and back; sit comfortably with your back well supported.

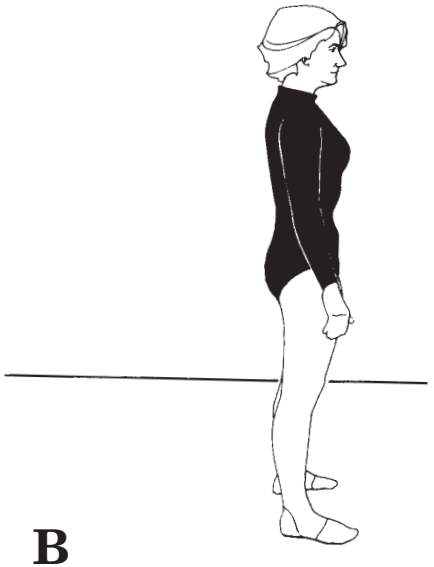
Maintain even weight through your buttocks. Sit with even weight through your thighs - avoid holding your knees together.

Support both of your feet on the floor or on the wheelchair pedals - avoid pointing your foot downwards.



A

Poor Posture



B

Ideal Posture

Standing Position

Head and neck - as for sitting.

Spine - as for sitting.

Place equal weight through both feet. (Feet should be six to ten inches apart).

Walking

1. Check your posture. Leaning forward causes the centre of gravity to fall in front of your feet and increases the tendency to fall forward.

2. Try to put equal weight through both feet.

3. Concentrate on bringing your leading foot directly forward by bending the hip and knee; avoid swinging the leg sideways.

4. Strike with the heel as you step onto the leading foot. As you stand on the leg, try to avoid snapping the knee back (into hyperextension). This can damage the knee joint.

5. It is better to walk well for shorter distances than badly for longer distances. A walking aid may be necessary for some people (for safety, conserving energy, and improving your walking ability). It is advisable to see a Physiotherapist who will prescribe the appropriate aid and instruct you in its use.

6. You may be unaware of changes in your walking. Concentrating on the correct technique each and every time you walk can help you to correct any faults.

Exercise Programme

General Guidelines
Your Physiotherapist will guide you in your selection and performance of the exercises.

In preparation for exercising, it is recommended that you wear loose comfortable clothing and supportive, low-heeled footwear.

Categories
Most of the exercises are categorized according to their degree of difficulty. Category A exercises are most suitable for those people who are relatively mobile and can maintain their balance in sitting and standing. These exercises are also more difficult than those outlined in Category B and require more energy to perform.

Category B exercises are designed for those people who are less independently mobile and who may require some assistance to assume and/or maintain the positions outlined.

Exercising in Sitting
Select a comfortable chair that allows adequate back support. It should have a stable base (not on wheels or castors). The chair height should permit your feet to be fully supported on the floor.

If you have problems with your sitting balance, choose a chair with supportive armrests.

Exercising in Standing
If you have problems with your balance, it is essential that you have some firm support to hold onto while you exercise in standing. Ideally, this should be approximately waist height (kitchen counter, window sill, firm tabletop, etc.).

Mobility

1. ***To get out of bed*** - Roll onto your side, lower your legs slowly over the side of the bed, and push up with your arms/hands to a sitting position.

   You may find it beneficial to rest for a short time in this position before trying to stand.

2. ***To stand up*** - Place your feet flat on the floor (6 to 10 inches apart), lead forward to stand up slowly, trying not to push with your hands unless necessary.

   Try to take equal weight on both feet.

   If spasticity is a problem for you, try to straighten your knees slowly, with control (avoid locking the knees).

Stretching Exercises

Stretching exercises are less energy-consuming than strengthening exercises and can be done several times during the day. It may be beneficial to do them in the morning before getting up and at any other time when you feel stiffness (spasticity) in the arms, back, or legs.

These exercises should be performed in a slow, smooth, and controlled manner. If the stretches are performed in this way, you should feel the tight muscles relax. These exercises can be very helpful for those who experience muscle cramping or stiffness.

Remember:
****Never stretch to the point of pain.**
****Do not hold your breath!** Try to breathe as normally as possible during the stretching exercises.

Neck

Starting Position: Sitting

Sitting in a chair, feet supported, back straight. Try to keep your shoulders level.

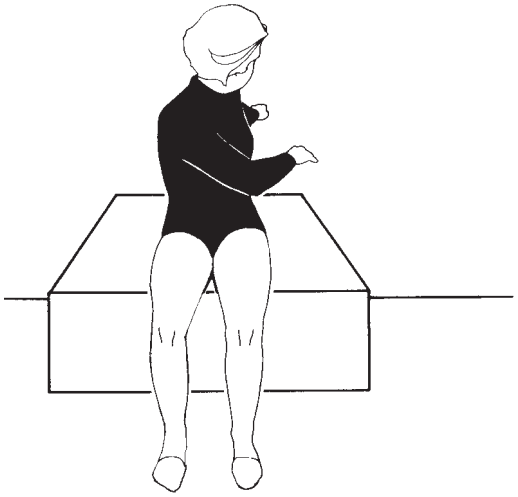
1. Look down to the floor, then up to the ceiling and return to the starting position.
2. Turn your head to look over your shoulder; look left then right.
3. Move your ear down to one shoulder then to the opposite side.

Relax the shoulder muscles by shrugging your shoulders up toward your ears, then relax them completely.

Repeat _____ times.

Purpose: To prevent neck stiffness.

Trunk



A

Starting Position: Sitting

Sitting on a **chair** or the **edge of the bed**.

1. Twist/rotate your trunk to each side (turn to look behind you).

2. Twist/rotate your trunk as you bend forward (reach your right hand to the outside of your left foot).

3. Stretch/elongate one side of your trunk (lift your shoulder toward your ear).

Repeat _____ times.

B

Starting Position: Sitting

Sitting on a **chair**, feet supported on the floor.

1. Bend forward to rest your elbows on your knees. Return to upright position.

2. Holding onto your chair with one hand, reach with the other hand as you turn to look over your opposite shoulder.

3. Twist/rotate as you bend forward, bringing your shoulder to the opposite knee.

4. Holding onto the chair with one hand, lift the opposite shoulder towards the ear.

Repeat _____ times.

Purpose: To improve sitting balance.
To improve trunk flexibility.

Starting Position: Lying

Lying on your back with your knees bent and your feet flat on the bed.

1. Keeping your knees together, slowly roll to one side, as far as you can, without forcing the movement. Keep your shoulders on the bed.

   Now slowly roll to the other side.

Repeat _____ times.

Purpose: To reduce muscle spasm in the legs.
To stretch the lower back and hip muscles.

A

Starting Position: Sitting

Sitting on a **chair**.

1. Bend one knee toward your chest and gently pull with your arms. You should feel a stretch in the low back and hips. Hold for 10-30 seconds. Repeat with the other leg.

Repeat _____ times.

B

Starting Position: Lying

Lying on your back with knees bent, feet flat on the bed.

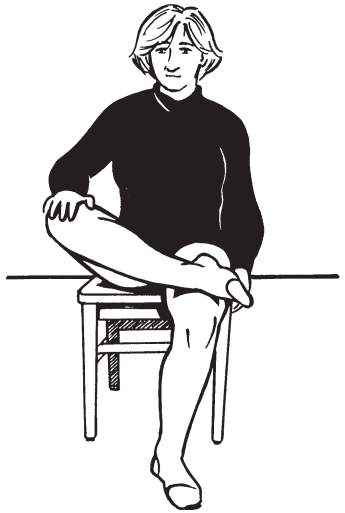
1. Bend one knee toward your chest. Gently pull with your arms. You should feel a stretch in the lower back and hips. Hold for 10-30 seconds. Repeat with the other leg.

NOTE: If you have painful knees, place your hands behind your thigh as you pull the knee towards you.

Repeat _____ times.

Purpose: To stretch the muscles of the lower back and hip.

Hip Stretch



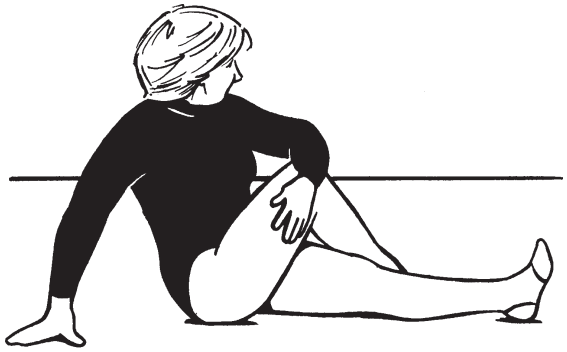
A

Starting Position: Sitting

Sitting on a **chair**.

Place your right foot on your left knee.
Stretch the hip by pushing the right knee towards the floor.
Hold for 10 seconds. Repeat with other leg.

Repeat _____ times.



B

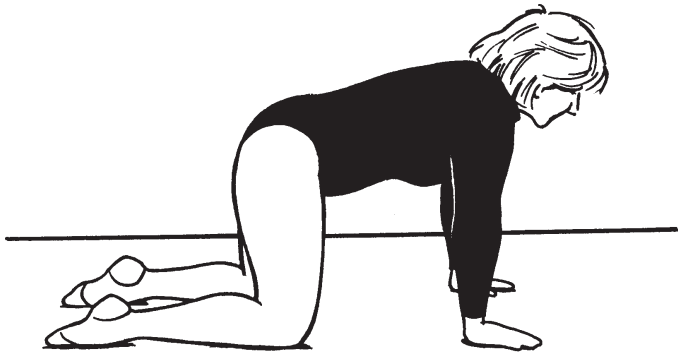
Starting Position: Sitting

Sit on the floor; with your left leg straight and right leg crossed over. Place your left arm around the right knee and gently stretch the buttock muscles by pulling the bent knee across the body. Hold the stretch for 10-15 seconds and then relax.
Repeat with other leg.

Repeat _____ times.

Purpose: To stretch the muscles around the hip joint.

Trunk Stretch



Starting Position: Hands and Knees

On your hands and knees, hands directly below your shoulders, knees directly below your hips. Try to tighten your stomach muscles, tilting the hips and flattening your lower back.

Keeping your hands in same position; sit back on your heels or as far as is comfortable. Hold for 10-20 seconds and then return to starting position.

Repeat _____ times.

Purpose: To stretch the muscles of the trunk and hips.

Inner Thigh

A

Starting Position: Sitting

Sitting on a bed or floor, knees bent. (Cross-legged).

1. Let your knees relax slowly toward the floor. You will feel a stretch in the inner thighs. Hold for 10 to 30 seconds and then relax.

Do not force the movement.

Repeat _____ times.

B

Starting Position: Sitting

Resting against a wall or the back of a sofa, or sitting in an armchair. (see diagram).

1. Let your knees relax slowly to the side as far as is comfortable. Hold for 10 to 30 seconds. Relax.

Do not force the movement.

Repeat _____ times.

Purpose: To stretch the muscles between your legs.
To prevent muscle tightness.

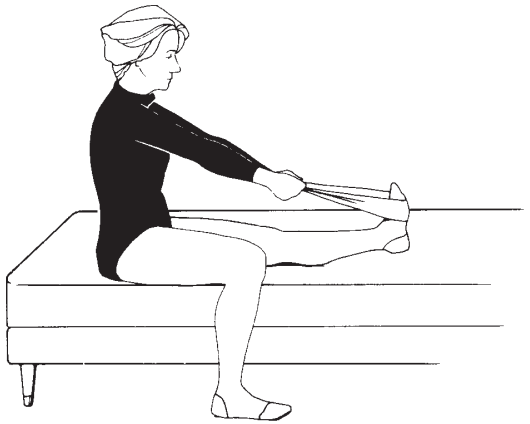
Hamstrings

A

Sitting on the bed or the floor, straighten the left leg and bend the right leg so that the sole of the foot touches the inner thigh.

1. Slowly lean forward from the hips until you feel a stretch behind the knee. If you cannot reach your toes comfortably use a towel to help you stretch. Repeat with other leg.

Repeat _____ times.



B

Sitting on the edge of a couch or bed place one leg on the bed or couch, if necessary place your hands just behind your buttocks for support and balance.

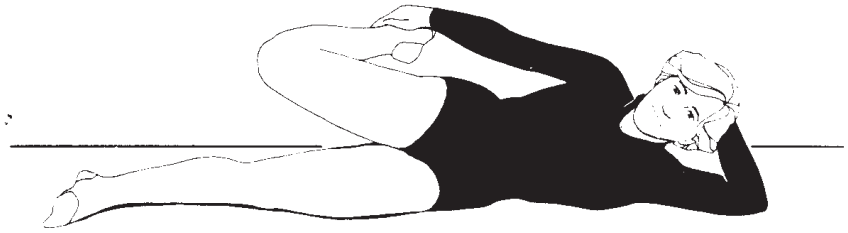
1. Lean forward from the hips until you feel a stretch behind the knee. Hold for 10-30 seconds. For an added stretch to the calf muscles use a towel as illustrated. Repeat with other leg.

NOTE: You should not experience any neck or back pain when doing this stretch. If you do, you may be performing it incorrectly. Ask your therapist to check your technique.

Repeat _____ times.

Purpose: To stretch the muscles behind your knee.

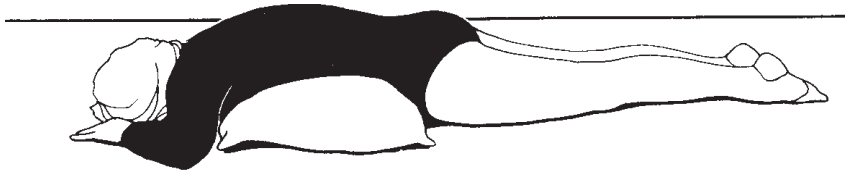
Quadriceps



A

Starting Position: Lying on Side

Lie on your left side. Hold the top of your right foot between the toes and ankle joint and pull the right heel toward the buttock to stretch the front of the thigh. Hold the stretch for 10-30 seconds then relax.



B

Lying on Stomach

Rest on your stomach for a short session every day (10 to 30 minutes).

Place a pillow under your waist if you experience any back discomfort.

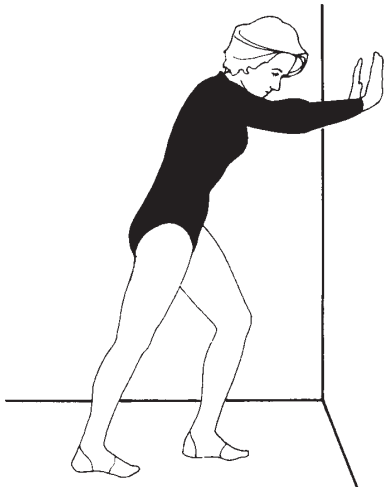
You may require some help to assume this position.

Repeat _____ times.

Purpose: To stretch the muscle on the front of the thigh.

Achilles Tendon/Heelcord

A



Starting Position: Standing (facing the wall)

Standing about 2 to 3 feet away from the wall, place your hands against the wall.

1. Bend one knee and place the foot in front of you, keeping the other leg straight behind.

2. Lean forward from the hips, bending your elbows and keeping your back straight until you feel a stretch in the calf of the straight leg. Hold for 10-30 seconds. Relax. Repeat with the other leg. To add a Soleus stretch, slightly bend the back knee, keeping the foot flat. This gives you a much lower stretch of the calf muscle.

Repeat _____ times.

B

Starting Position: Sitting

Sitting with your feet on the floor, keep your heels in contact with the floor.

1. Pull your foot up towards you. Hold for 10-30 seconds. Relax. You may use a towel under the ball of the foot to increase the stretch. Repeat with the other foot.

   You should feel a stretch at the back of your ankle and lower leg (calf).

NOTE: This may not be advisable if you have back problems. Ask your physiotherapist to suggest an alternative method.

Repeat _____ times.

Purpose: To stretch the calf muscle (achilles tendon)

Strengthening Exercises

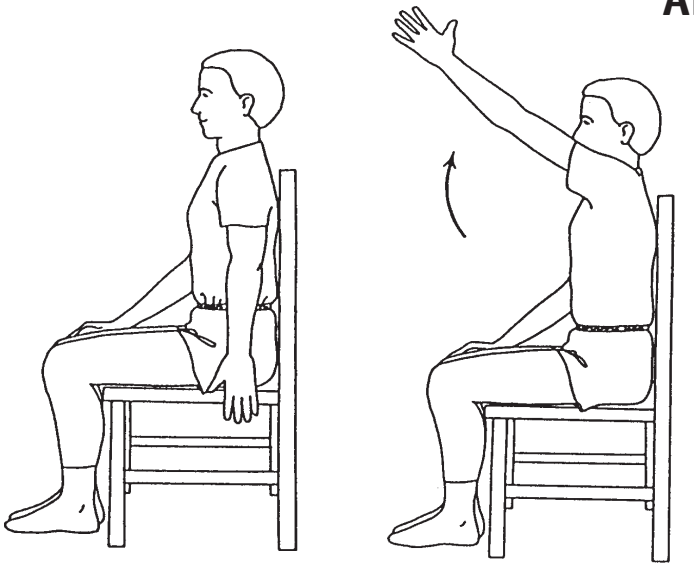
Strengthening exercises require more energy than the stretching exercises. Be selective with the number and type of exercise you decide to do. **DO NOT** feel that you must do all the exercises at once; instead, select them according to the demands of your day to day activities. For example, if you have walked or stood for long periods, select an exercise that works your arms.

For people with mitochondrial myopathy, the problem can be both lack of endurance as well as muscle weakness. Muscle strength is increased by adding resistance (for example, weights or elastic). It is important to start with low resistance and slowly increase the difficulty of the exercise.

There is a fine balance between muscle strengthening and fatigue, therefore, do only the number of repetitions prescribed. Be sure to discuss any problems you may have with the exercises with your Physiotherapist.

Arm Exercises

A



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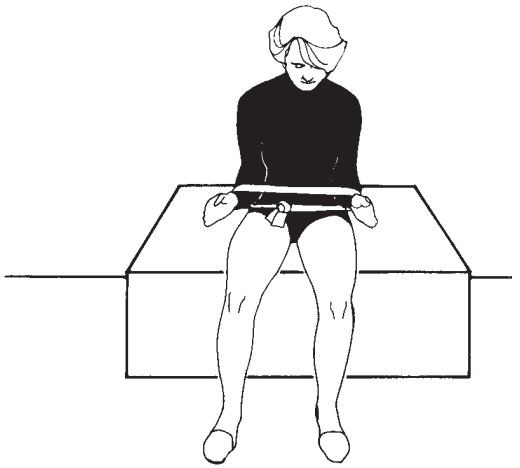


Starting Position: Sitting

Shoulder Flexion - Active

Lift _____ arm over head with thumb up and elbow straight.

Hold _____ counts.
Repeat _____ times.

Progress to _____ lbs. at wrist/hand.

Sitting on a chair or the edge of the bed.

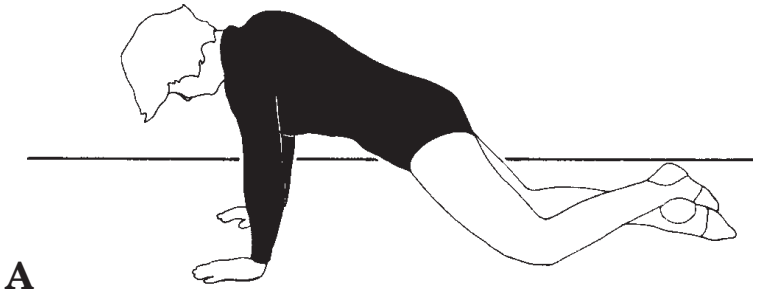
1. Tie elastic around forearms. Keep the elbows close to your body, palms facing inwards. Separate forearms against the resistance of the elastic. Hold the position for as long as you are able, without shaking or discomfort.

2. Tie elastic around forearms. Hold your arms out in front of you, elbows straight. Separate your arms against the resistance. Repeat in a variety of arm positions (palms up, down, in and out).

Repeat _____ times.

Purpose: To strengthen your shoulder muscles.
To help prevent stiffness of your shoulders.

Arm Exercises



A

Starting Position: Hands and Knees

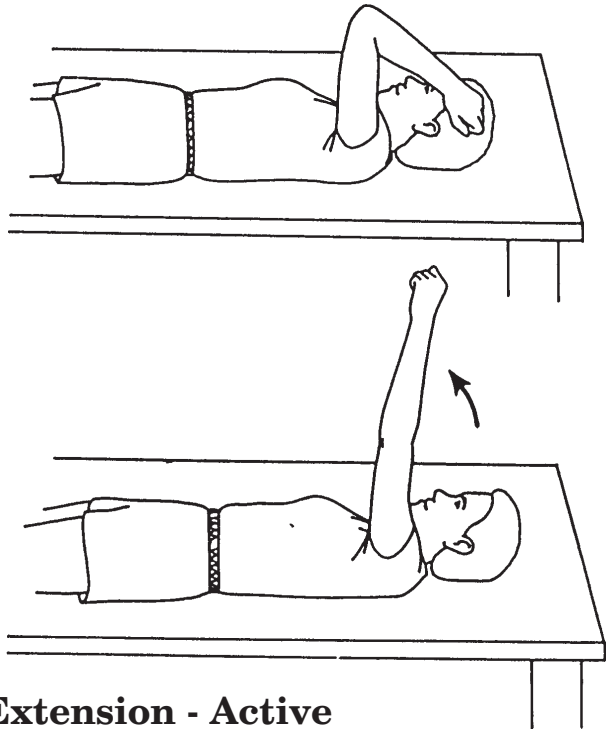
Modified Push-up

On your hands and knees. Place your hands under your shoulders. Pelvic tilt (tighten abdominal muscles to flatten the lower back).

1. Bend your elbows, lower your body keeping your back straight; knees remain bent.

   Straighten your elbows. Raise your body, keeping your back straight.

Repeat _____ times.



B

Elbow Extension - Active

Lie on back, _____ elbow pointing to ceiling. Straighten elbow.

Hold _____ counts.
Repeat _____ times.

Progress to _____ lbs. at wrist/hand.

Repeat _____ times.

Purpose: To strengthen the pushing muscles of the arms used in transfers, pushing a wheelchair, etc.

Abdominals

A

Starting Position: Lying

Lying on your back with both knees bent.
Assume a "pelvic tilt".

Tuck your chin in, lift your head and shoulders off the floor. Reach your hands towards your knees. Hold for 5 seconds then lower slowly.

Variations/Progressions:

a) Diagonally up/down
(reach your hands to the opposite knee).

b) Lower more slowly, holding your position at different points.

Repeat _____ times.

B

Starting Position: Lying

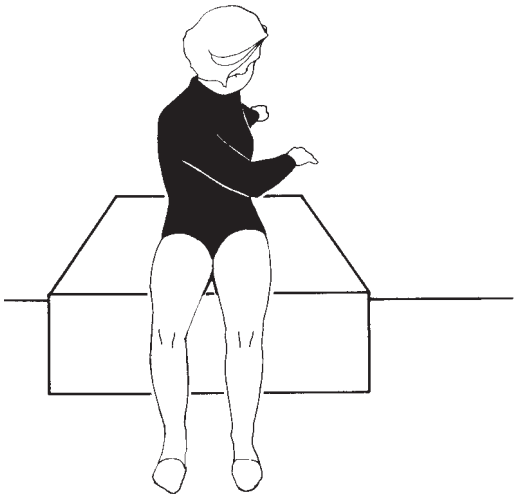
Lying on your back with both knees bent and feet flat, press the lower back down onto the floor or bed. You should feel your stomach muscles tighten. Hold this position as you slowly raise one leg three or four inches off the floor. Do not allow the back to arch. Hold for _____ seconds and lower slowly. Repeat with other leg.

Repeat _____ times.

Purpose: To protect the lower back by strengthening the abdominal muscles.
To improve trunk control.

Trunk Exercise

A



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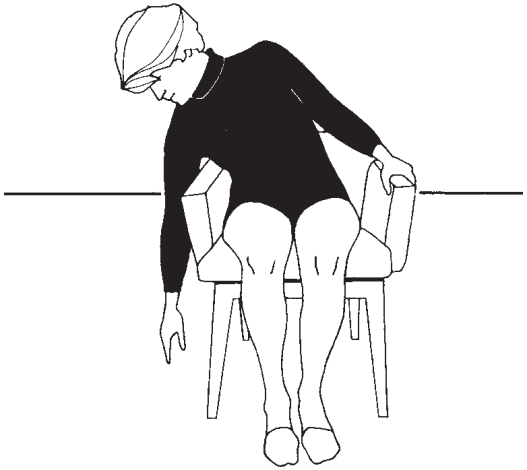


Starting Position: Sitting

Sitting upright **without support** (i.e. chair without arms, or edge of bed).

Twist from the waist to look behind you. Let both your arms swing as far as possible to the left and then to the right. Bend sideways to touch the floor. Avoid bending forward. Repeat to the other side.

Repeat _____ times.

Sitting

1. Holding on to the armrests of the chair, turn your shoulders to allow you to look to the left and right.

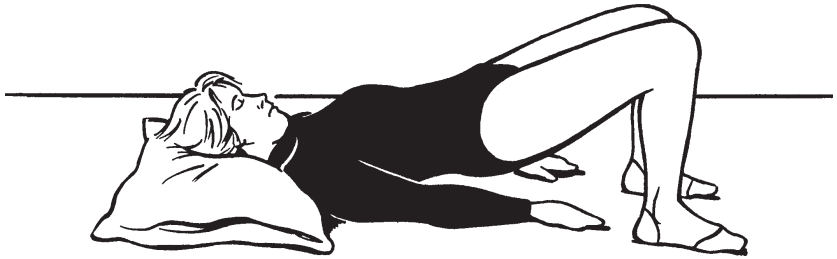
   Do not force the movement.

2. Hold the opposite armrest as you bend sideways.

Repeat _____ times.

Purpose: To improve trunk strength and control.
To improve sitting balance.

Trunk Bridging



Starting Position: Lying

Lying on your back, knees bent, feet together flat on the bed. Keep your knees together if you can.

1. Tighten your abdominal muscles and flatten the small of your back onto the bed ("pelvic tilt").

2. Lift your hips slowly up from the bed ("bridging"). Do not arch your back. Hold for 5 to 10 seconds. Lower slowly.

3. **Progression** Pelvic tilt as before. Lift hips off bed. Now lift one foot off the bed and hold for 10 seconds and then lower. Repeat with other leg.

4. **Further Progression** 1 leg only. Lift hips off the bed, hold for 10 seconds and then lower. Repeat with other leg.

Repeat _____ times.

Lying

Lying on your back, knees bent, feet flat on the bed. You may require some help to assume/maintain this position.

1. Tighten your abdominal muscles and flatten the small of your back onto the bed ("pelvic tilt").

2. Lift your hips slowly up from the bed ("bridging"). Hold for 5 to 10 seconds. Lower slowly.

These suggestions may help:

a) Tie a piece of elastic around your thighs just above the knees.

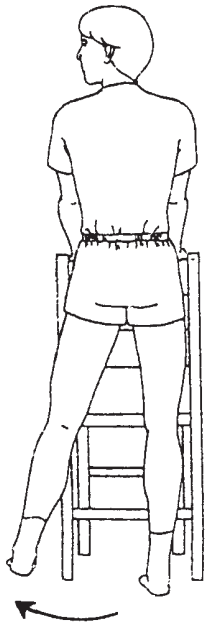
b) Have someone hold your feet.

c) Rest your feet on a non-skid surface.

Repeat _____ times.

Purpose: To improve trunk/hip control.

Hip Abductors



A

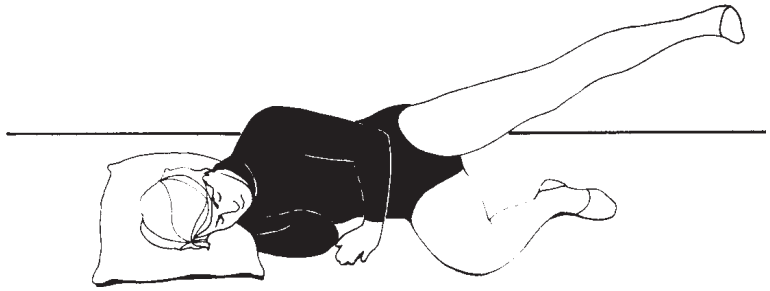
Starting Position: Standing

Hip Abduction - Active

Standing, hold onto chair. Raise _____ leg out to side. Keep toes pointed straight ahead.

Hold _____ counts.
Repeat _____ times.

Progress to _____ lbs. at thigh/ankle.



B

Starting Position: Lying on your side

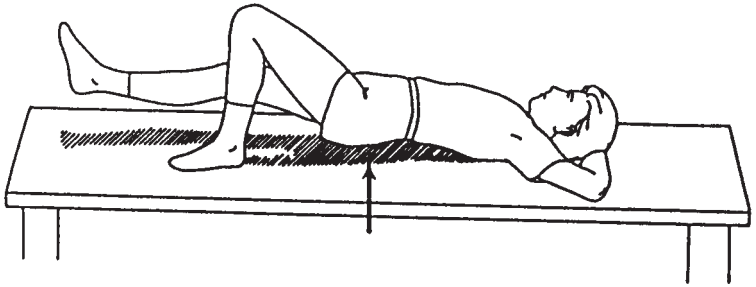
Lying on your side with your bottom leg bent.

1. Keeping the top leg straight, raise it up about 6 inches.
2. Hold for 5 seconds and lower slowly.
3. Turn onto your other side and repeat.

Repeat _____ times.

Purpose: To strengthen the hip muscles used in standing and walking.

Hip Extensors



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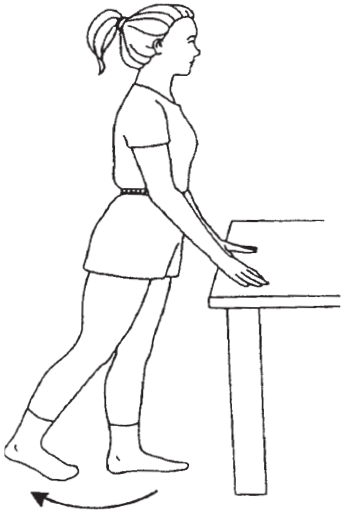


B

Hip Extension - Active

Lie on back, _____ knee bent and foot flat.
Lift bottom and opposite leg up.

Hold _____ counts.
Repeat _____ times.

Hip Extension - Active

Standing, hold onto mat. Lift _____ leg backward with knee straight.

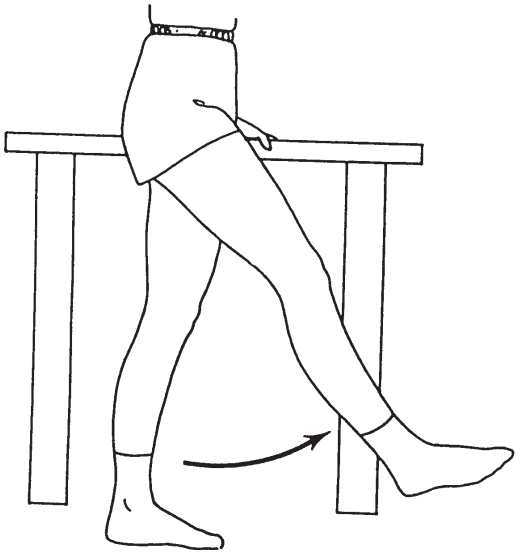
Hold _____ counts.
Repeat _____ times.

Progress to _____ lbs. at thigh/ankle.

Purpose: To strengthen the seat muscles.

Hip Flexors

A



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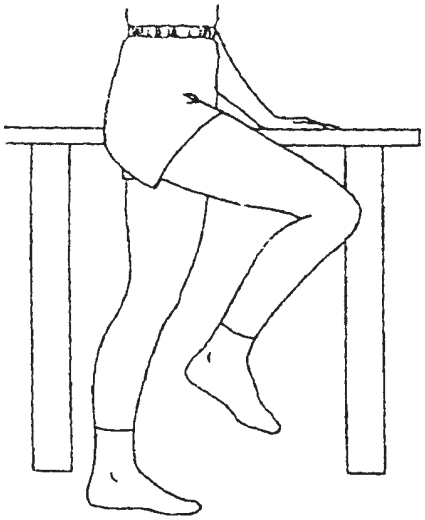


Starting Position: Standing

Hip Flexion - Active

Standing, hold onto mat. Raise _____ leg forward with knee straight.

Hold _____ counts.
Repeat _____ times.

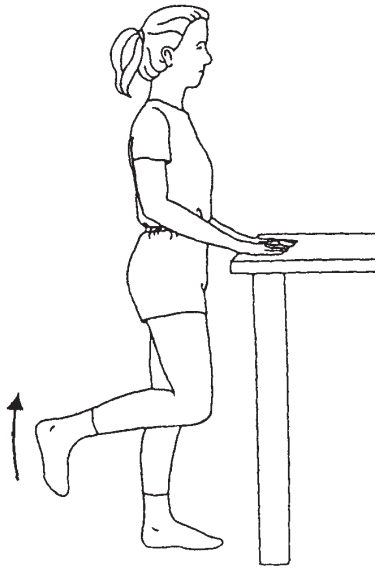
Progress to _____ lbs. at thigh/ankle.

Hip Flexion - Active

March in place.
Repeat _____ times/minutes.

Purpose: To strengthen the hip muscles used in walking.

Hamstrings



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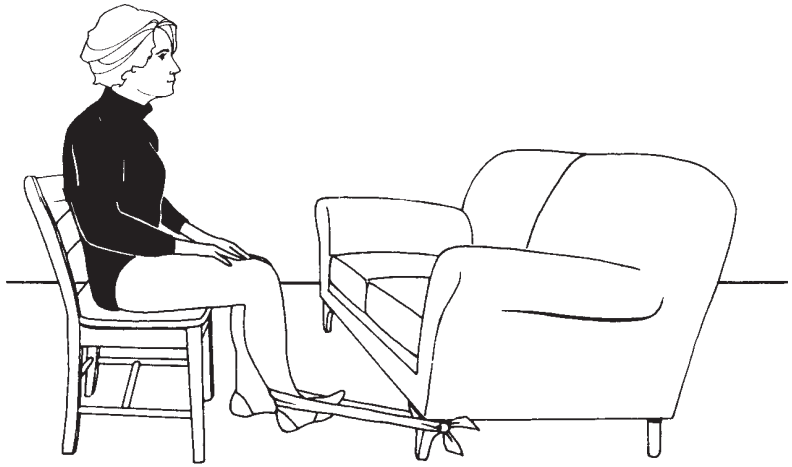


B

Starting Position: Standing

Knee Flexion - Active

Standing, hold onto mat. Bend _____ knee.

Hold _____ counts.
Repeat _____ times.

Progress to _____ lbs. at ankle.

Starting Position: Sitting on a chair, feet supported.

1. Tie a length of elastic to the leg of a stable piece of furniture.

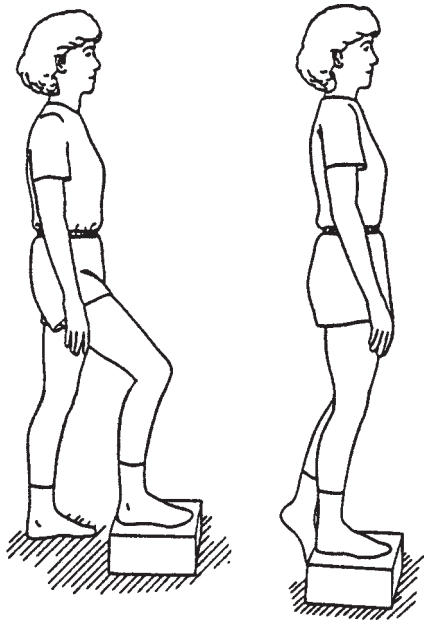
2. Lift the foot a few inches off the ground and then pull the heel backwards under the chair. Hold for 5 seconds and relax.

Repeat _____ times.

Purpose: To strengthen the muscles that bend your knee.

Quadriceps

A



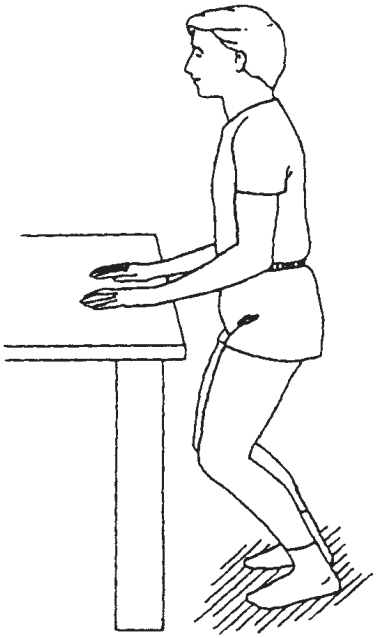
Starting Position: Standing

Knee Extension - Active

Stand with _____ foot on step.
Raise body up with left on step, straightening knee.
Do not raise other foot onto step.

Hold _____ counts.
Lower self down slowly from step.
Repeat _____ times.

B



Standing

Knee Extension - Active

Standing, hold onto mat. Bend knees halfway.

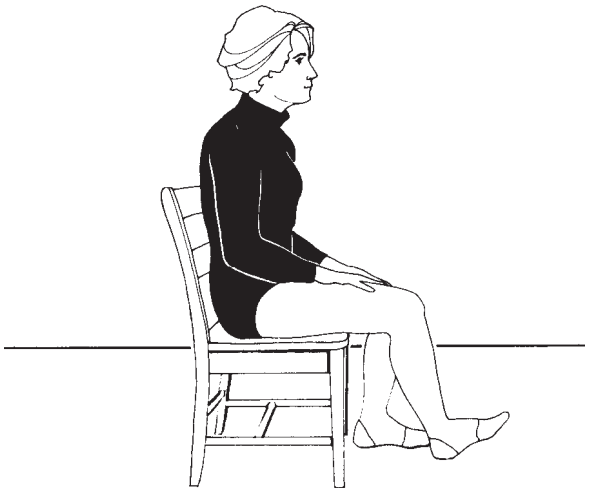
Hold _____ counts.
Repeat _____ times.

Purpose: A and B - To improve knee muscle strength.
A - To improve control of your hips and knees.

Ankle Dorsiflexor

A

B



Starting Position: Sitting

1. Sitting with your feet firmly supported on the floor. Tie a piece of elastic around your feet.

2. Keeping your heels on the ground, lift your feet up and out against the resistance of the elastic. Hold for 5-10 seconds.

> **NOTE:** To do this exercise correctly hold your knees and heels together.

Repeat _____ times.

Sitting

Sitting with your feet firmly supported on the floor.

1. Lift feet up either one foot at a time or together (heels stay on floor). Do not allow feet to turn inward.

2. Hold knees and heels together while trying to separate feet.

3. Foot circling, first in one direction, then in the opposite direction.

Repeat _____ times.

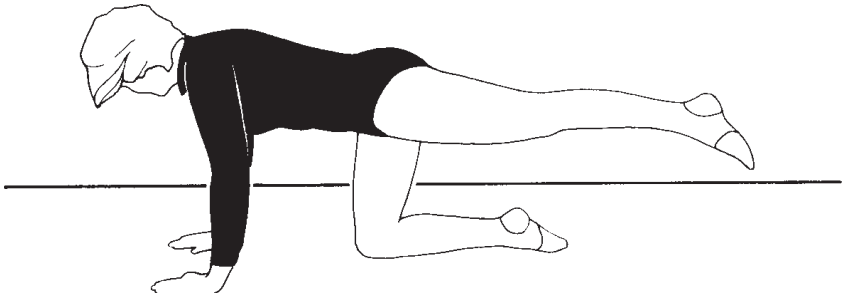
Purpose: To strengthen the muscles used to control the foot during walking.
To prevent tightening of the heel cords.

Balance Activities

Impaired balance is a common problem for many people who have mitochondrial myopathy. Good balance and coordination of movement involves a smooth, well-controlled, automatic response between the muscles moving the body and limbs. Walking is an example of an activity that requires good balance and coordination. When this is impaired, safety may also be a problem.

Balance activities are more energy-consuming than stretching exercises and should be performed selectively according to the demands of your daily activities.

It is most beneficial to perform these exercises ***slowly, smoothly, and with as much control as possible.*** Concentration on performing the exercises correctly is important. Your Physiotherapist will guide you in the correct technique and appropriate selection.



A

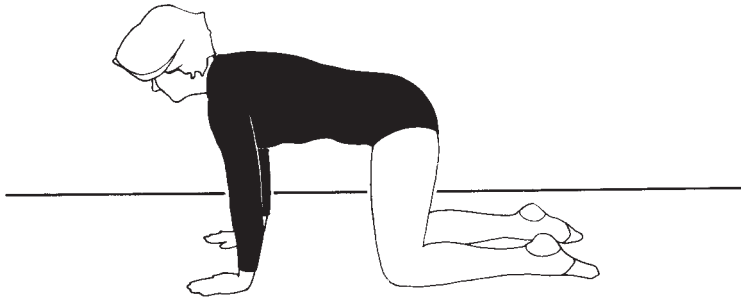
Starting Position: Hands and Knees

On your hands and knees, hands directly below your shoulders, knees directly below your hips. Try to maintain the "pelvic tilt".

1. Stretch one arm out in front of you. Lower. Repeat with the other arm.

2. Lift one leg out behind you, then bend your knee toward your chest. Lower. Repeat with the other leg.

3. **Further Progression:** Alternate arm and leg extension. Hold, then lower. Repeat with opposite arm and leg.



B

Hands and Knees

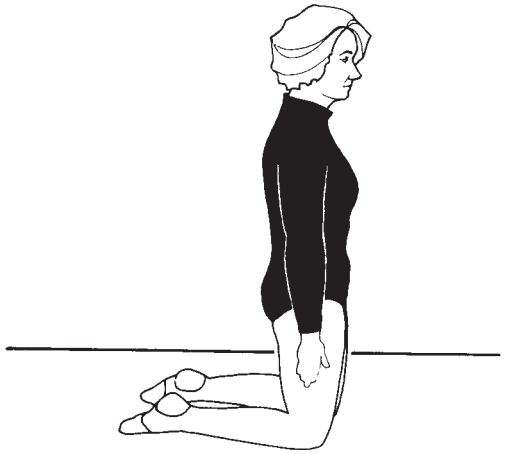
Assume and maintain the position described in exercise A.

1. Concentrate on keeping your trunk still. Avoid any swaying motion.

Repeat _____ times.

Purpose: To increase your trunk control.
To improve your balance.

On Your Knees



A

Starting Position: Kneeling

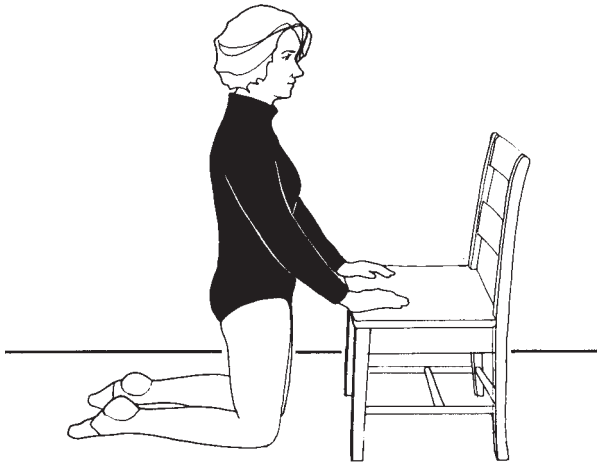
Position your knees directly under your hips, knees 8 to 10 inches apart. Maintain a "pelvic tilt".

1. Maintain the position.

2. a) Move one knee forward 6 to 12 inches.
   b) Move the knee backwards to the starting position.
   c) Repeat with the other knee.

3. Walk sideways on your knees to the right, then to the left. Focus on keeping your trunk still as you move sideways.

Repeat _____ times.



B

Kneeling

For support, place your hands on a chair in front of you.

1. Maintain the kneeling position.

2. a) Move one knee forward several inches.
   b) Move the knee backwards to the starting position.
   c) Repeat with the other knee.

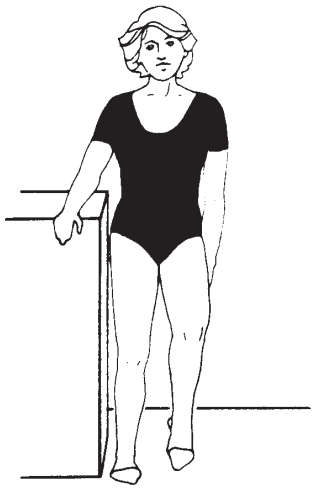
3. Walk sideways on your knees.

Hold the chair while performing these exercises.

Repeat _____ times.

Purpose: To strengthen muscles used in walking.
To improve your trunk control.

Standing



A

Starting Position: Standing

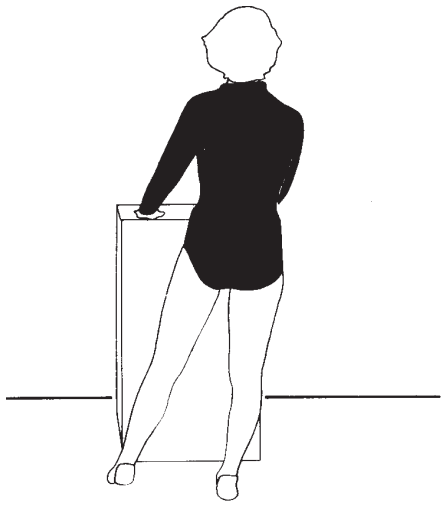
Stand beside a supportive surface such as the kitchen counter or a table (at least waist height). Place your feet 8 to 10 inches apart.

1. Keeping the knee of the supporting leg slightly bent, lift the opposite foot off the floor. Hold for 5 seconds or longer if able. TRY NOT TO WOBBLE.

Progression Standing on the supporting leg, slowly bend the knee and then straighten.

NOTE: Emphasis is on control of the movement, not the speed.

Repeat _____ times.



B

Standing

Stand beside a supportive surface such as a kitchen counter or table (at least waist height). Place your feet 8 to 10 inches apart.

1. Bend one knee, step backwards and touch the floor with your toe.

2. Step forward and touch the floor with your heel.

3. Walk sideways slowly, concentrate on lifting and placing your feet correctly. Use support to help you maintain your balance.

Repeat _____ times.

Purpose: To improve your walking.

Endurance Exercise

The purpose of endurance exercise is to increase your heart rate above its resting rate to challenge your cardiorespiratory system. This type of exercise should be done regularly to maintain the strength of your heart and breathing muscles. Because these muscles may be affected by the mitochondrial disease, it is very important that you consult with your doctor before beginning endurance exercise. You should also work closely with your physiotherapist to develop an individualized endurance program.

It is generally recommended to do endurance exercise for 20 minutes 3 times per week. However, when you are just starting an exercise program, you should start very slowly, perhaps exercising continuously for as little as 2 minutes. As your endurance improves, you can slowly build up to exercising continuously for 20 minutes.

Because endurance exercise is aimed at working your heart muscle, it is important to monitor how hard your heart is working. This can be done by taking your pulse before, during and after your exercise session. You should aim to exercise at 60% of your maximum heart rate. Your physiotherapist will teach you how to take your pulse and measure your maximum heart rate.

Bicycling on a stationary bike or doing a walking program are two simple ways to perform endurance exercises.

Relaxation — An Adjunct to your Exercise Programme

Everyone, whether experiencing the symptoms of mitochondrial myopathy or not, is subject to variable levels of daily distress or "stress". The stress response is essentially a complex set of chain reactions that occurs in the body when a person is subjected to meaningful physical and emotional pressures. This is beneficial to us in short bursts, heightening our ability to perform properly and to maintain healthy reactivity. Once the conflict or problem has been dealt with, we should experience a relaxation response or recovery phase, allowing us to regain a healthy state of physical and emotional balance.

Although the causes of stress are different for each person, over a long period of time, too much stress can be harmful and has been associated with fatigue and illness. For those who are already dealing with mitochondrial myopathy, this may further impair their general health and function. Since we cannot always control how much stress we are faced with, it is important for us to learn to control our reaction to stressful events. The ideal way for us to counteract many of the harmful effects of stress is to learn how to bring about the relaxation response.

The basic technique for obtaining the relaxation response can be learned quickly and simply. It can become an enjoyable part of healthy daily life with a little planning and initial effort, especially if practised several minutes daily.

Some people obtain the relaxation response when completely absorbed in a personal exercise programme or when participating in an enjoyable activity in which they are concentrating fully. This is another important reason to exercise regularly. Others prefer to practise meditation or relaxation exercises in a quiet, comfortable, uninterrupted setting. A simple example of one of many types of relaxation exercises is:

1. Assume a well-supported position of comfort. Let your eyes close gently. Breathe deeply from the abdomen (diaphragmatic breathing). Inhale and exhale comfortably to avoid straining or breath holding. Become aware of the day's events and your thoughts or worries, gradually letting them drift into the background of your awareness.

2. As your body relaxes, imagine letting any tension you are storing in your muscles "melt away". Begin at your feet and allow your body to progressively "let go" or relax as you move up to your head. Concentrate on feelings of comfortable warmth and heaviness, repeating these thoughts mentally to yourself: "My feet and legs are heavy and warm"; "My back and abdomen are heavy and warm"; "My breathing is deep and regular"; "My hands and arms are heavy and warm"; "My forehead is smooth and cool"; "I am calm and relaxed".

3. Be aware of how each part of your body feels as you release tension and think of warmth and heaviness. Give yourself 5 to 30 minutes to achieve a deep sense of relaxation. Try not to force yourself to concentrate or to let go of tension. Instead, breathe comfortably and deeply, maintaining a reasonably passive attitude — allow any other thoughts to leave your awareness as you focus on the phrases outlined.

Further instruction in breathing and relaxation techniques can be provided by your Occupational Therapist or Physiotherapist.

Your Personalized Exercise Programme

Strengthening Exercises:

Page	No. of repetitions	Any comments

Endurance Exercise:

Time	Type of Activity	Target Heart Rate

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