

Management

Several reviews on the current management of LEOP and PPS have been published.^{5,118,120,121} These authors agree that many post-polio individuals can benefit from a multidisciplinary, individualised management program. This section will review the current approach to management of LEOP described in the literature. A summary of the management strategies that have been described in a number of articles that have been written on the management of this condition and several research studies that have recently emerged are outlined in Table 4

All patients with a history of polio can benefit from a thorough medical assessment and at least some of the management strategies that are outlined in this section. Although the individual may not be exhibiting late onset problems, an understanding of the disease process, a balance of activity and rest, optimal orthotic fitting and weight control can be beneficial in reducing the possible development of future problems.

Table 4: Management Strategies for the Late Effects of Polio

MANAGEMENT OF WEAKNESS

- Strengthening exercise (isometric, isotonic, isokinetic)
- Aerobic exercise
- Stretching exercise
- Avoidance of muscular overuse
- Energy conservation – pacing, rest, activity reduction
- Weight loss
- Orthoses and assistive devices

MANAGEMENT OF FATIGUE

- Energy conservation – pacing, resting, activity reduction
- Lifestyle changes
- Weight loss
- Prescription of aids
- Aerobic exercise
- Medications

MANAGEMENT OF PAIN

Post-polio muscular pain

- Stretching exercise
- Moist heat, ice and stretching
- Orthoses
- Assistive devices
- Energy conservation – pacing, activity reduction
- Medications

Biomechanical pain

- Postural correction
- Strengthening exercise
- Stretching exercise
- Orthoses
- Assistive devices
- Biofeedback and muscle relaxation
- Non-steroidal anti-inflammatory medications
- Steroid injections
- Surgery

Treatment of other superimposed neurologic disorders

- Includes carpal tunnel syndrome, radiculopathy, spinal stenosis
- Surgery
 - Assistive devices
 - Orthoses

Overuse pain

- Medications
- Moist heat, ice, ultrasound
- Energy conservation
- Assistive devices
- Orthoses

Fibromyalgia

- Posture correction
- Medication – amitriptyline, cyclobenzaprine
- Aerobic exercise

MANAGEMENT OF RESPIRATORY DYSFUNCTION

- Preventive measures (pneumococcal vaccine, influenza vaccine)
- Ventilatory assistance
- Identification and treatment of sleep disordered breathing
- Training in glossopharyngeal breathing, assisted coughing
- Stretching of tight accessory respiratory muscles and muscle relaxation
- Postural correction – management of scoliosis
- Aerobic exercise
- Weight loss

MANAGEMENT OF DYSPHAGIA

- Referral for speech pathology assessment of swallowing
- Modification to food and fluid consistencies
- Trial and implementation of compensatory/facilitatory swallowing techniques
- Monitor fatigue

MANAGEMENT OF DYSARTHRIA

- Assessment of oromusculature and motor speech function
- Counselling
- Exercise

MANAGEMENT OF COLD INTOLERANCE

- Multiple layers of clothing
- Massage
- Localised heat

MANAGEMENT OF PSYCHOSOCIAL DIFFICULTIES

- Interdisciplinary approach
- Counselling, education, support
- Post-polio support group
- Evaluation and treatment by social workers, psychologists and psychiatrists

(Compiled from Thorsteinsson, 1997¹²⁰; Halstead, 1998¹¹⁸ and Trojan and Finch, 1997¹²¹)

Management of Weakness

New or increased muscle weakness in PPS is caused by overwork, disuse or a combination of both of these factors. It is essential that the underlying cause of muscle weakness is determined so that appropriate management strategies can be developed. The management of new weakness may include:

- Strengthening exercise (isometric, isotonic, isokinetic);
- Aerobic exercise;
- Stretching exercises to decrease or prevent contractures;
- Education regarding energy conservation techniques including pacing, rest, activity reduction and the avoidance of muscular overuse;
- Weight loss; and
- Prescription of orthoses and assistive devices.

If muscle weakness is secondary to disuse, low intensity non-fatiguing strengthening exercise or low-intensity aerobic exercise may be of benefit. Details regarding the use of exercise for post-polio individuals is outlined in the following section on exercise.

In several studies, muscular overuse in subjects with a history of paralytic polio has been thought to be the cause of increased weakness. If weakness is secondary to chronic overwork and fatigue, muscles require rest, and further overuse of muscle must be avoided. Patients should be encouraged to rest and pace activities (refer to following section on lifestyle modification). Orthoses may also be used to assist in resting isolated, weakened muscles (refer to following section on orthoses and mobility aids). Strenuous activities producing a decline in muscle strength should be avoided. However, muscles that have been affected by polio readily atrophy with disuse. It is, therefore, essential that strength changes are monitored closely following the prescription of rest, reduced activity and orthoses.

Management of Fatigue

Post-polio fatigue can be managed with the use of:

- Education regarding energy conservation techniques and lifestyle changes;
- Weight loss;
- Prescription of orthoses and assistive devices;
- Aerobic exercise; and
- Pharmacological treatment.

The most important aspect of the treatment of fatigue is educating the patient regarding energy conservation techniques. Teaching the patient the concepts of pacing activities, rest and work simplification can assist the patient in conserving their cardiopulmonary endurance and reduce the symptoms of fatigue (refer to following section on lifestyle modification). If the patient fails to adopt these basic management principles other measures, e.g. aerobic exercise, will be of little benefit.

Although some patients may be deconditioned, the presence of unrelenting fatigue may preclude the prescription of a modified aerobic training program (refer to following section on the role of exercise). In this case, the prescription of rest may have greater justification. If fatigue cannot be managed through activity reduction and rest, significant lifestyle changes may be required, e.g. changes to the work situation and home management responsibilities.

Muscle fatigue, associated with overwork of specific muscle groups, often responds well to localised rest and the use of orthoses to provide protection to the involved muscles and joints. As a result, the prescription or modification of orthoses and walking aids may be required (refer to following section on orthotics and mobility aids). Recent changes to the construction of orthoses have replaced heavier materials that were formerly used in fabrication of braces with more lightweight materials. These lighter materials significantly reduce the workload required of the individual.

Medications that have been trialed for the management of fatigue in the post-polio population include pyridostigmine, amitriptyline, selegiline and bromocriptine. (For further information regarding these trials, refer to the following section on pharmacological therapies)

Management of Pain

Pain in post-polio individuals can result from a variety of causes. Management of pain should therefore depend upon the aetiology. Pain management is based on a number of principles, which can be supplemented by specific recommendations. These basic principles include:¹¹⁸

- Improve abnormal body mechanics, such as poor posture and gait deviations;
- Relieve or support weakened muscles and joints through bracing and the use of ambulatory aids; and
- Promote lifestyle modifications that conserve energy and reduce stress.

Treatment for post-polio muscular pain may include:

- Application of therapeutic modalities including moist heat and ice;
- Stretching – to maintain extensibility of muscle and connective tissue;
- Prescription of orthoses and assistive devices;
- Education regarding lifestyle modifications, activity reduction and pacing (refer to following section on lifestyle modification); and
- Pharmacological treatment.

Treatment of overuse and biomechanical pain may include:

- Physiotherapy:
 - Electrotherapy (e.g. TENS, ultrasound)
 - Application of therapeutic modalities including heat, ice
 - Strengthening exercise
 - Joint mobilisation
 - Muscle relaxation and biofeedback
 - Stretching of tendons and soft tissues, myofascial release techniques
 - Hydrotherapy;
- Modification of extremity use, e.g. periodic rest;
- Retraining of posture and body mechanics to minimise overuse and reduce or avoid pain during activities of daily living and work;
- Pacing activities;
- Bracing to alleviate symptoms and prevent further acceleration of joint and muscle overuse, to control joint deformities and failing joint fusions (refer to following section on orthoses/bracing);
- Prescription of mobility devices (refer to following section on mobility devices);
- Pharmacological treatment – Non-steroidal anti-inflammatory medication;
- Surgery; and
- Treatments for fibromyalgia – postural correction, medication (amitriptyline, cyclobenzaprine), aerobic exercise.

Postural Correction

Abnormal postural alignment in patients with a history of paralytic polio can frequently be attributed to muscle imbalance. Postural deformity can lead to pain and decreased energy efficiency during various activities. Addressing postural deformities can often be helpful in minimising or preventing pain and increasing endurance for sitting, standing, walking and other activities.

Management of postural deformities can be achieved through:

- Strengthening and stretching exercises;
- Education about back care and correct use of body mechanics;
- Referral to a comprehensive back care program;
- Education about appropriate posture and resting positions;
- Prescription of adaptive aids, e.g. lumbar rolls;
- Prescription or modification of orthoses/braces;
- Prescription of mobility aids; and
- Weight management – cardiovascular exercise and referral to a dietician (refer to following section on weight management).

Common biomechanical deficits requiring orthotic management include:

- Inadequate dorsiflexion in swing – secondary to weakness of ankle dorsiflexors. May be treated with an ankle foot orthosis (AFO);
- Dorsiflexion collapse in stance;
- Genu recurvatum (knee hyperextension) – usually caused by weakness of the quadriceps. Person often locks the knee when mobilising to improve stability of the lower extremity. Often can be managed with an AFO, knee orthosis or in patients with more severe weakness, a knee ankle foot orthosis (KAFO) may be required;
- Genu valgum (valgus deformity of the knee); and
- Mediolateral ankle instability.

Referral to an orthotist with a thorough understanding of this patient group is desirable to ensure that an appropriate, well fitting orthosis is prescribed.

Mobility Devices

For many patients with a history of polio, the extended use of crutches, the use of manual wheelchairs for many years and asymmetrical or abnormal gait patterns are the major source of weakness, pain and fatigue. Although the patient may be experiencing extreme difficulties with their mobility, changes or modifications to their current method of locomotion may be difficult for them to consider. Rather than use a mobility aid, many individuals make significant lifestyle changes to compensate for their decline in mobility, such as limiting their social and outdoor activities.

Prevention of further disability and restoration of lost function often require a decrease in the amount of walking or wheelchair propulsion and a change to methods that do not result in weakness, pain and fatigue. It is important that a thorough evaluation of the patient is conducted by a physiotherapist or occupational therapist prior to the prescription of any mobility device. Prescription of mobility aids should be based on the patient's functional status, their needs and the potential for progressive deterioration.

The objectives of prescribing a mobility aid are to:

- Ensure more stable balance and reduce risk of falls;
- Minimise fatigue and energy required for ambulation;
- Promote improved posture; and
- Alleviate load on joints.

When considering the appropriateness of a mobility aid for a post-polio patient, the following factors need to be considered:

- Balance;
- Strength and function of upper and lower limbs;
- Cardiovascular endurance and fatigue levels;
- Current or future use of orthotic devices;
- Compliance; and
- Environment.

Shoulder, elbow and wrist injuries are common in post-polio individuals who have relied on crutches or wheelchairs for ambulation. As a result, a thorough assessment of the client's upper limb function is required before the prescription of a mobility device.

Management of Respiratory Dysfunction

The conditions under which the patient experiences respiratory difficulties must be identified before development of a management program. Often the management of individuals with respiratory complications requires referral to a respiratory physician for comprehensive evaluation and management.

The following recommendations are a brief overview of some of the important factors regarding the management of respiratory dysfunction in these patients. It is essential that patients who are experiencing respiratory problems are referred for a comprehensive assessment and treatment program that a respiratory physician can provide.

General management strategies include:

- Preventive measures (pneumococcal vaccine, influenza vaccine);
- Ventilatory assistance – non invasive methods preferred;
- Identification and treatment of sleep disordered breathing;
- Training in breathing techniques and assisted coughing;
- Inspiratory muscle training;
- Stretching of tight accessory respiratory muscles and muscle relaxation;
- Postural correction – management of scoliosis;
- Aerobic exercise; and
- Weight loss.

Management of Sleep Disturbances

Sleep disturbance may be caused by pain, stress, underventilation or obstructive apnoea. Due to the complex nature of sleep disturbances, the cause needs to be identified before the development of management strategies. As a result, referral for sleep studies may be required. In addition to addressing respiratory dysfunction that may be responsible for these problems (as discussed above), modifying the patient's sleeping position and the number of pillows used, may provide some relief. Pain that the patient experiences at night may also need to be addressed.

Management of Dysphagia

Dysphagia management should be undertaken by a speech pathologist who has expertise in the assessment, diagnosis and treatment of swallowing disorders.

Speech pathology intervention of swallowing disorders may include:

- Clinical and/or radiographic assessment of swallowing;
- Provision of counselling regarding observed swallowing problems associated with PPS and strategies to facilitate safe swallowing;
- Modifying the consistency of food and/or fluids;
- Trial of compensatory/facilitatory swallowing techniques; and
- Design of exercise programs to improve range, strength, speed and coordination of muscles used in swallowing.

Management of Dysarthria

As in the case of dysphagia, patients with motor speech difficulties should be referred to a speech pathologist for management of their condition. Speech pathology management of dysarthria may include:

- Assessment of the oromusculature (e.g. lips, tongue, soft palate) and motor speech function including the parameters of respiration, phonation, resonance, articulation, prosody and speech intelligibility;
- Provision of counselling regarding identified motor speech problems associated with PPS and strategies to promote speech intelligibility. For example, using shorter sentences, reducing rate of speech, or avoiding talking over background noise; and
- Provision of exercises to improve hypernasality, voice quality and volume of voice.

Management of Cold Intolerance

The management of cold intolerance is largely symptomatic and may include:

- Multiple layers of clothing – especially when placed on the affected extremities first and then on the rest of the body;
- Massage (toward the heart); and
- Short term use of local heat (20 minutes or less) – special care must be taken when using heat by any person with diminished sensation or peripheral vascular disease.

Weight Management

Weight reduction is an important and effective way of reducing the workload on muscles. For patients experiencing pain, fatigue and muscle weakness, even relatively small increases in weight can have a significant effect. For many people with a history of polio, weight loss is a challenge due to the difficulties that they experience when exercising. Body weight norms that are used for the general population are often not appropriate for those who have had polio and have poor musculoskeletal development. The patient should ideally be in the low to middle end of the body mass index range, depending on their degree of impaired growth and development.¹²² Dietetic counselling and support is essential in ensuring that weight control is incorporated as a permanent modification to the patient's lifestyle, rather than being regarded as a short term plan.

Pharmacological Therapies

In regard to the use of pharmacological therapies in the treatment of PPS, Dr Pesí Katrak has written the following:

Anecdotally, a number of pharmacological agents have been reported to show improvement in symptoms of post-polio syndrome. All of these are case reports on a small number of patients only. There are very few randomised, controlled trials in PPS patients. The largest study was a randomised, multi-centre trial on 126 PPS patients¹²³ on the use of pyridostigmine. This was a placebo-controlled trial, which failed to show that pyridostigmine¹²⁴ produced an improvement on measures of fatigue and strength. An earlier, open trial with pyridostigmine on a small number of patients had shown improvement in fatigue and strength in patients receiving this medication. Other randomised placebo-controlled trials using Amantadin¹²⁵ on 25 patients and Prednisone¹²⁶ on 17 patients did not show a significant improvement in fatigue or strength. Small case studies with two to five patients have been reported using Selegiline,¹²⁷ Bromocriptine¹²⁸ and human growth hormone.¹²⁹ It is not possible to draw any conclusions from these case reports. Overall, there is no evidence to indicate that any pharmacological agent improves the symptoms of weakness or fatigue in post-polio syndrome patients.

Psychological Management

To overcome the combination of denial and personal history of successful coping that is often found in polio survivors, an interdisciplinary approach to psychological problems is helpful. Each member of the team brings with them specific skills and knowledge that could assist the patient address some of the issues that have resulted from the new symptoms that the patient is experiencing.

The main aims of treatment of the post-polio patient should be to:

- Increase and expand the patient's personal and external resources;
- Provide education and support; and
- Reinforce the need for the patient to have control over their lives.

Several strategies have been successfully utilised by clinicians to assist patients enhance their coping skills. These strategies have included:

- Assisting the patient in identifying their current and previous coping strategies.
- Encouraging the patient to make necessary lifestyle changes including relaxation, stress management, energy conservation and work simplification.
- Encouraging the patient to focus on past achievements and identify personal strengths rather than focusing on the new weaknesses.
- Encouraging the patient to keep the lines of communication open though:
 - Sharing literature
 - Talking with others; and
 - Attending workshops and relevant information sessions (when available)

This can be achieved through referring the patient to a local post-polio support group and by providing the patient with adequate information and resources.

- Encouraging the patient to be an active participant in managing their own needs through:
 - Setting limits
 - Reminding others of their needs; and
 - Seeking support and information.
- Encouraging the patient to be aware of their own feelings and the feelings of others (including family members) by:
 - Showing appreciation for the contribution of others; and
 - Seeking help before difficulties evolve.
- Encouraging the patient to recognise their feelings of loss and grief and provide support to them and their families through this process.
- Referring to other health professionals, including psychologists, psychiatrists and social workers, to address unresolved issues.

Lifestyle Modification

Because the aetiology of PPS is believed to be related to overwork of polio damaged nerves and muscles, it is often necessary to advise post-polio patients to make lifestyle changes to reduce the symptoms of pain, fatigue and weakness and prevent further decline in function. These lifestyle changes often present a challenge not only to the patient but also to the health professional recommending these changes.

Occupational therapists can assist the patient in making the necessary changes to their lifestyle by encouraging them to evaluate their lives, make the identified changes and to guide the individual to reframe their expectations for success by focusing on innovative ways of achieving new goals.

By educating the patient on specific energy conservation, joint protection and work simplification techniques, it is hoped that the patient develops the necessary skills required to modify or pace any activity or behaviour. These skills include the ability to:

- Identify activity related pain, fatigue and weakness and the activity that caused it;
- Analyse activities according to the potential energy use;
- Analyse body mechanics during daily activities and identify those aspects that need to be changed;
- Recognise and correct poor joint protection behaviours; and
- Analyse their posture in various situations and identify aspects that need to be changed.

To better equip the patient and their family members to make any necessary changes to their daily life, it is essential that they have a thorough understanding of the:

- Disease process;
- Reasons why they are experiencing these symptoms of fatigue, pain and muscle weakness; and
- Advantages of incorporating energy conservation techniques into their lifestyle.

The patient should be supported through this process and assured that although some of these changes may be difficult, they are necessary, and benefits will be seen. Family members should be included in all aspects of this process so that they may develop a better understanding of the new problems facing these individuals.

The lifestyle changes that may need to be incorporated into the patient's management plan and daily life include:

- Energy conservation techniques;
 - Activity analysis
 - Pacing / scheduling
 - Rest
- Joint protection; and
- Work simplification.

Exercise

Considerable controversy surrounds the prescription of exercise for post-polio patients because the pathophysiology of this condition remains unclear and because there have been case reports of overwork weakness amongst this population. It has been shown that individuals with a history of polio can increase their muscle strength and cardiovascular endurance by following a well structured, individualised training program.

Exercise prescription for the post-polio patient should only be carried out by a physiotherapist who has a thorough knowledge of the general principles of exercise prescription and an understanding of the effects of exercise on this group of patients. Even though several different forms of exercise have been shown to be beneficial in this population, exercise should be used judiciously and should be completely avoided in some patients.

Exercise must be individualised because:

- Each person has a varying degree of weakness and musculature affected;
- Exercise must be modified according to pain, fatigue, exercise tolerance and posture;
- Medical history and any previous surgical procedures must be taken into account; and
- Every person has his or her own needs, goals and interests.

Who should not be exercising?

People who push themselves beyond the point of fatigue with their daily tasks should probably not be prescribed an exercise program. These people may have weakness due to overuse of their muscles. They may notice an improvement in their strength and fatigue levels in they reduce their activity. These patients should be taught the principles of energy conservation and be assisted to modify their lifestyle to reduce fatigue and muscular overuse. Specific muscle groups that are being overused may benefit from rest or supportive devices. If these measures are effective, the person may then become a candidate for an exercise program.

Who should be exercising?

Post-polio patients who should be prescribed an exercise program include:

- Those who keep their fatigue under control by practising energy conservation and pacing themselves;
- Those who lead more sedentary lives where fatigue is no longer a problem; and
- People who are overweight.

The types of exercise that may be prescribed to a post-polio patients will be briefly explained.

Cardiovascular Exercise

The aims of aerobic exercise include:

- Improved heart function and efficiency – the average level of aerobic fitness in post-polio patients is 5 METS – similar to the fitness of patients following a myocardial infarction;
- Improved circulation;
- Improved respiratory function;
- Improved efficiency of working muscles; and
- Decreased blood pressure.

On the basis of scientific studies of the effects of aerobic exercise on post-polio subjects, the general features of aerobic exercise programs should be:

- Low intensity and non-fatiguing exercise;
- Activities the patient enjoys – to improve compliance; and
- Low resistance activities that are least likely to fatigue compromised muscles. These activities may include walking, cycling on a level surface, swimming and hydrotherapy

Strengthening Exercise

Several studies have shown that people with a history of polio can improve their muscular strength and endurance by following an individualised, carefully monitored exercise program. However, at this stage, there is no consensus in the literature regarding the best strengthening exercise protocol to follow. The key factor appears to be intensity. Most authors recommend that strengthening exercise should be non-fatiguing.

Isometric exercise is most useful in muscles with a grade of less than 3 or in muscles over a painful joint. Isometric exercise may promote circulation and help retain some joint stability in body parts with this degree of weakness. Isotonic and isokinetic exercise is most useful in muscles with grade 3 or better strength and without a painful joint.

Stretching Exercise

Shortening of trunk and limb muscle is common in patients with a history of polio, particularly in those patients who are non-ambulatory. Muscle shortening may contribute to pain and decrease movement efficiency. Prescription of specific stretches for localised muscle tightness may be indicated as part of a physiotherapy program.

Gentle stretching of tight muscle in the post-polio patient may:

- Improve posture;
- Relieve muscle tension and cramping;
- Reduce the risk of musculotendinous and joint range of motion;
- Prevent irreversible contractures; and
- Increase general flexibility before strengthening exercises.

It must be noted that reduced flexibility is not necessarily detrimental. Tightness of certain structures may help to provide stability and improve function. Therefore, stretching is not always appropriate.

Hydrotherapy

Hydrotherapy is often the exercise method of choice for post-polio patients. When hydrotherapy is used in combination with other physiotherapy techniques, it has been found to improve muscle strength, range of movement, balance, coordination and endurance.

Hydrotherapy is particularly beneficial to the post-polio population because:

- The scope of water activities can benefit post-polio patients with all levels of ability;
- Exercising in water is a very pleasant and encouraging way to exercise particularly for non-mobile patients;
- Warm water promotes muscle relaxation and improved circulation;
- It allows particular movements to be either assisted, supported or resisted by the buoyancy of water; and
- It reduce weight bearing and can decrease mechanical stress on limbs, depending on the level of immersion.

It is essential that the instructor or therapist is aware of the patient's medical condition and the approach to exercise that is appropriate for these patients.

Surgical Considerations¹¹⁹

There are few studies regarding the effects of surgery or anaesthesia in post-polio individuals. However, there are certain factors that need to be considered prior to surgery. These include:

- Regional anaesthesia is preferable to general anaesthesia because it has fewer side effects. Individuals at greatest risk of complications during general anaesthesia are those with a history of ventilatory use or swallowing difficulties, those with involvement of the shoulders, arms or trunk, and individuals with a history of respiratory problems.
- In general, polio muscles tend to be more sensitive to muscle relaxants than normal muscles. As a result, a reduced dose of muscle relaxants is usually recommended.
- Close monitoring of pulmonary function is critical after general anaesthesia.
- Sleep apnoea may be aggravated following general anaesthesia.
- Healing may be delayed in paralysed limbs due to decreased blood supply.
- Polio-affected muscles may be temporarily weaker after general anaesthesia and may increase the need for ambulatory support.
- Recovery may be prolonged by two or three times beyond what is expected for the general population, depending on the individual's age, extent of paralysis and length of surgery.
- A supervised program of graded exercise may be required to reverse the effect of bed rest.