On the Road ...

to Health & Fitness

A starter's guide for people with quadriplegia.

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BENEFITS OF EXERCISE

Exercise increases strength and endurance which:

- are needed for wheeling, and in particular for negotiating inclines and curbs,
- are important for independence in daily activities,
- may limit the incidence of injuries related to higher stress activities like transferring between locations of uneven heights,
- are beneficial for many leisure and sport activities.

Exercise improves aerobic or cardiovascular fitness which:

- improves the efficiency of the heart at rest and during exercise,
- improves blood flow to muscles and skin during exercise,
- decreases the risk of heart disease by improving cardiovascular function, improving blood lipid profile, and assisting in weight control,
- provides more energy and minimizes fatigue.

Exercise improves general health by:

- helping to control body weight.
- providing a sense of well being.

Ask yourself:

Do I have energy for all the things I like to do, or want to do?

Am I happy with my current fitness level?

Am I happy with my current weight?

If the answer is no to any of these questions, engage in regular exercise and pay closer attention to diet. If you participate in regular exercise and follow a balanced diet, you will begin to lead a healthier lifestyle with more energy for all activities.

Start exercising at a reasonable intensity based on your fitness, and progress slowly. High intensity exercise increases the likelihood of injury as it places more strain on the body than moderate intensity exercise. Also, high intensity exercise is not necessary to achieve the fitness levels associated with optimum health and wellness.

For a long term active lifestyle

Choose exercise activities you enjoy, as you are more likely to maintain them.

Make regular exercise a part of your daily routine.

EXERCISE PROGRAMS

A balanced fitness program should include exercises for both muscle strength and aerobic conditioning.

Optimally you should exercise 4-5 days each week, with a minimum of 4 days devoted to aerobic types of activities.

Exercise workouts more than 5 days each week have few advantages and may lead to overtraining and a greater susceptibility to injury. A healthy body needs both exercise and rest. When engaged in a very active lifestyle, rest days should be interspersed with exercise days to provide a rest day mid week as well as one at the end of the week.

If you are over 40 years of age and male, or over 50 years of age and female, and intend to engage in strenuous activity or exercise programs, you should obtain medical clearance first. If your doctor has indicated that you have cardiovascular disease, or high blood pressure at any age, seek medical advice before engaging in an exercise program.

Endurance Training

Endurance exercise is required for aerobic conditioning, and leads to improved cardiovascular fitness. To obtain cardiovascular benefits, exercise must be of sufficient intensity, duration, and frequency, each week to produce changes. (See general guidelines on page 4)

For people with quadriplegia, the larger the muscle mass in the upper limbs, the greater the ability for aerobic conditioning.

For many people with quadriplegia, regular endurance exercise also minimizes the symptoms of low blood pressure (hypotension) such as lightheadedness or dizziness.

Free wheeling is effective **if** an individual can wheel fast enough, or the terrain is such that a moderate intensity can be maintained. For example, an unobstructed outdoor pathway, long stretches of wheelchair accessible sidewalks, or a track are suitable. However, wheeling in a crowded mall is unlikely to provide the increased and sustained work effort required to produce cardiovascular training effects. Free wheeling is often associated with periods of coasting and the effects of training may be less than anticipated. When free wheeling to improve aerobic conditioning, develop a hand strike pattern which keeps your arms moving. Sustain an effort which feels moderate to moderately hard. If the wheeling feels easy then it is unlikely to be producing any cardiovascular training benefits.

Resistance wheeling on wheelchair rollers or wheelchair ergometers is an effective means of training. These devices allow both speed and resistance to be used to increase intensity of the workout. Wheelchair rollers provide a means of exercising in all weather conditions. The ability to adjust resistance provides a strength training stimulus as well.

Wheelchair sports such as track and field, rugby, and swimming will improve aerobic fitness, whereas weight lifting, target shooting or table tennis have been shown to be ineffective. These latter sports should not be chosen for their ability to improve aerobic capacity. However, individuals engaged in any sports activities generally have higher fitness levels.

Arm crank training is a less specific exercise than wheeling, but is an effective means of improving aerobic fitness and strength. In general, for the same workload, the heart and lungs work harder during wheeling than during arm cranking exercise. As the muscle activity is quite different between arm cranking and wheeling, wherever possible, choose a wheeling activity over arm cranking. Wheeling improves aerobic capacity and works the muscles in the activity they have to perform most.

General Guidelines for Aerobic Exercise

Frequency: 4 - 5 days each week

Intensity: moderate to moderately hard work effort

Duration: 20 - 60 minutes at target work effort. Greater then 30 minutes is optimum.

Time: It takes at least 8-12 weeks of regular training 4-5 days each week before benefits are observed in most people with quadriplegia. These guidelines are slightly longer than those recommended for people with more muscles available for exercise training.

Cardiovascular training benefits are quickly lost if a minimal endurance activity level is not sustained, that is, if you do not continue to exercise within the guidelines outlined above for 3 days each week.

Exercise without adequate warm-up and stretches will predispose individuals to greater risk of muscle or tendon injury. Always include an adequate warm-up and stretch the muscles you will be using.

If you are unfit, any exercise training may feel hard or even very hard at first. This is not uncommon.

To Determine Exercise Intensity

*Unlike able bodied people, or people with lower cord injuries (paraplegics), heart rate is **NOT** a good indicator of exercise intensity for people with quadriplegia.*

With injuries above the level of T4, the nerves which increase heart rate during exercise are damaged, and heart rate response during exercise is usually impaired. Heart rate is no longer a good indicator of exercise intensity. For many individuals, heart rate will increase to near maximum levels of approximately 110-140 beats/minute with only moderate exercise. You will have to rely on the guidelines for how hard the work "feels" to gauge the intensity of a workout.

When exercising, ask yourself if the work feels easy, moderate, moderately hard, hard, very hard, or very very hard? Work within the "moderate effort" zone to start and after a couple of months work up to an intensity that feels moderately hard to hard. If the work feels very hard then the intensity is likely near the recommended upper limits and exercise intensity should be lowered. Similarly, if the workout feels easy then the intensity will be below a cardiovascular training threshold and benefits will be limited.

An exercise program should be:

- *4-5 days/week to **improve** cardiovascular fitness, and*
- *3 days/week to **maintain** a fitness level.*

As improvement occurs the same work will feel easier. Increased effort will then be required for further cardiovascular training benefits.

Because people with quadriplegia have a smaller muscle mass available for exercise (when compared to people with paraplegia), improvement is slower, but continuous **if** exercise is maintained. Try to devote 4-5 days/week for at least 6 months to improve fitness.

Your sense of EFFORT can be used to gauge the intensity of exercise.

How Work "Feels"	Training Zone
easy	below training threshold
moderate	lower training zone
moderately hard	mid training zone
hard	mid-upper training zone
very hard	upper limits of training zone
very very hard	above recommended training zone

Learn to read your body to determine how hard a workout feels.

Strength Training

Strength is important:

- *for functional activities such as transfers*
- *to obtain maximum aerobic exercise benefits*
- *to protect against upper limb injury*

Muscle weakness often exists in some muscles of the upper limbs, even in people leading fairly active lifestyles.

The muscles used in wheeling become stronger through repeated use, while those used less remain weaker. Wheeling is very good exercise to improve strength of certain muscle groups and enhance aerobic conditioning, but when performed without a complementary strength training program may create muscular imbalances. These muscle imbalances make you more susceptible to injury, particularly during activities such as transfers when body weight may be borne by both strong and weaker muscle groups.

Adequate strength and endurance training will not only benefit you for normal transfers and wheeling, but will help to minimize injuries. Specific strength training for <u>all</u> upper limb muscles is recommended.

During endurance (aerobic) exercise, benefits are derived both from improved heart and circulatory function and improvements in the exercising muscles themselves. Therefore, a sufficiently large exercising muscle mass is needed to gain aerobic training benefits. The larger the arm and shoulder girdle muscle mass involved in the exercise, the greater the potential aerobic training effects will be.

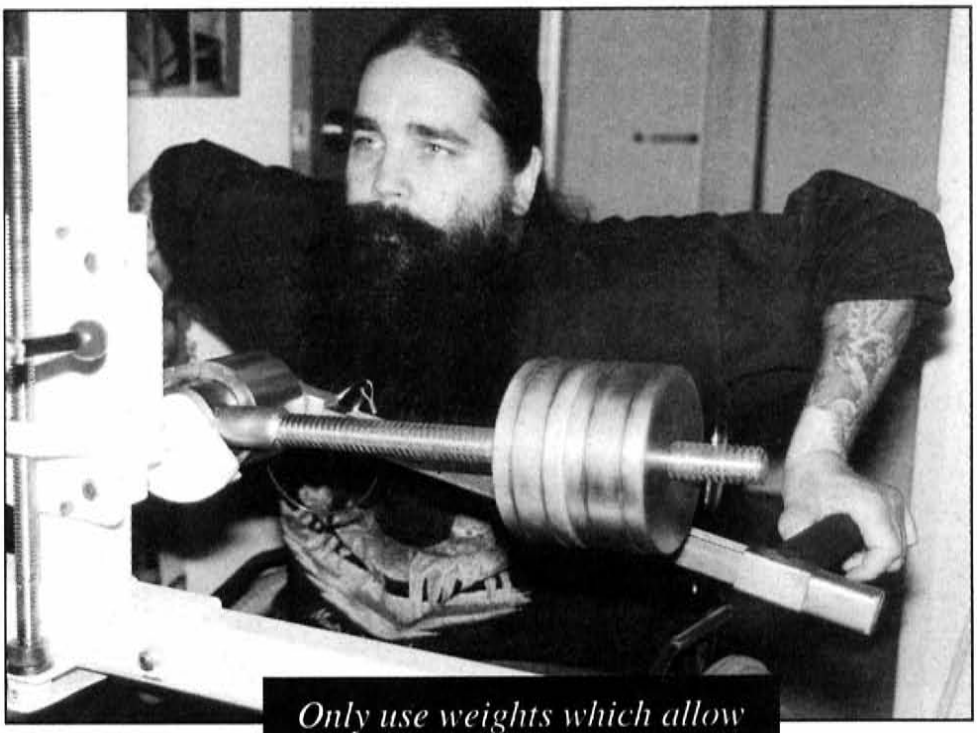
Strength training alone should not replace endurance training. Most strength training regimes do not produce cardiovascular training benefits.

Your body will reveal the benefits of regular strength training quite quickly, (in as little as 4 - 6 weeks).

Types of Strength Training

Both the *muscles* and the *nervous system* benefit from regular exercise. The most common form of weight or strength training involves the use of free weights (barbells, dumbbells). Other strength training equipment includes stack weight machines (plate weights routed through pulleys via cables), elastics (surgical tubing and bands) and other specialized devices such as accommodating resistance machines (like Nautilus™) and dynamometers.

Access to strength training equipment can be as easy as finding suitable household items, purchasing a set of dumbbells, or buying a membership at a reputable facility.



Only use weights which allow you to perform exercises in a controlled manner without struggling or jerking

Many strength training devices or equipment are not designed for people with loss of hand grip, nor those with muscle imbalances in the upper limb such as those found in many people with quadriplegia. Seek out facilities, equipment and personnel who can assist you with a safe strength training program. Strength training without adequate attention to safety may result in or aggravate muscle or tendon strains.

Successful Strength Training

- make a commitment to **regular** training (as little as 2 days/week)
- start with easily managed loads and **progress slowly**
- have a **well-rounded exercise routine** which targets all major muscle groups
- perform the exercise with **controlled motion** (not jerky)

*Select the **EXERCISES** for your workout.*

- Perform a balanced workout which includes exercises for all major muscle groups.
- Do not avoid weaker muscle groups as they will only get relatively weaker.

*Select a suitable **LOAD** for each muscle group.*

- The load should permit you to complete all repetitions of the first set without struggling and without interfering with normal breathing.
- Start at low loads and work up gradually.

*Determine how many **REPETITIONS** you will perform per set.*

- Typically 8-12 repetitions make up a set.

*Determine how many **SETS** you will perform for each exercise.*

- Typically 2-3 sets (each with 8 - 12 repetitions) are completed for each muscle group.
- The number of repetitions may be decreased between sets due to fatigue.

*Allow for **RESTS** between repetitions, between sets, and between muscle groups exercised.*

- Allow a momentary pause between each repetition.
- Allow a minute or two of rest between each set, and after each muscle group is exercised.

***PROGRESSION** is accomplished over a few weeks by:*

- gradually increasing the load (weight).
- increasing the repetitions (for example, from 8 to 12).
- decreasing the rest between sets (for example, from 2 to 1 minute).
- performing more exercises (a variety) for the muscle group.

Progress slowly. Change your workout periodically, but do not change too many things at once.

Make regular exercise a part of daily routine.

Warm-up muscles and stretch daily.

Warm-up

A warm-up is a period of low intensity exercise which gradually prepares the muscles for the main exercise session. It helps to prevent muscle or tendon injury and allows for a gradual increase in the workload for the heart.

Warm-up before endurance exercise by wheeling at an easy pace and gradually increasing the difficulty until you are at your training intensity after approximately 5 - 10 minutes. Many people with quadriplegia find a longer warm-up period beneficial.

Adequate warm-up should be a part of every exercise session.

Stretches

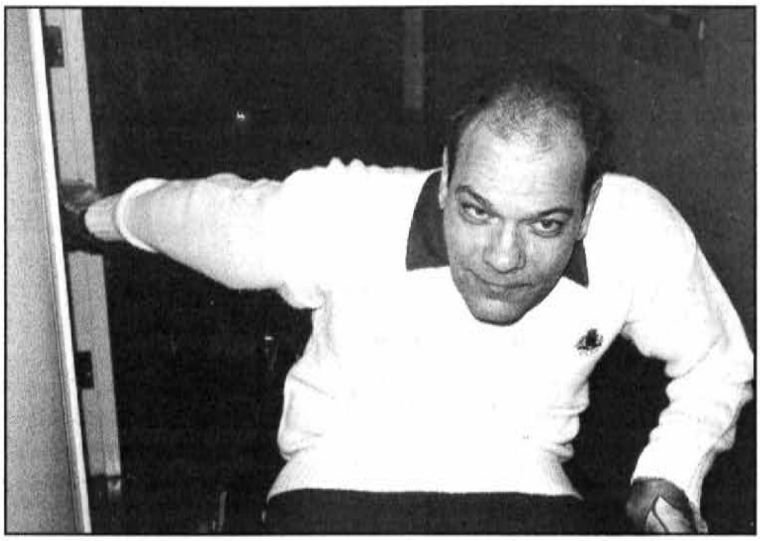
To improve flexibility and to prevent or treat muscle pain and stiffness ***daily stretching is recommended.***

If starting an exercise session from no activity at all then wheel for approximately 3 minutes at an easy pace or perform 3-5 minutes of low resistance arm exercises. Once the muscles have warmed up, stop and complete some neck, shoulder and shoulder girdle, and trunk stretches to improve flexibility.

At minimum, a muscle warm-up of 3-5 minutes and stretches of approximately 15 minutes should be performed 5 days each week.

Each stretch should be held for 10 - 20 seconds and repeated 3 - 5 times. Stretch smoothly, do not bounce or jerk. Stretch into the mild discomfort (not painful) range.

If you are unsure how to effectively stretch all muscle groups consult a qualified health professional or qualified fitness instructor. ***Effective*** stretching is an important part of both injury prevention and treatment of chronic muscle pain and/or muscle spasm.



Cool Down

At the end of the exercise period a free wheeling or low resistance cool down of approximately 5 minutes should be included to assist in recovery from exercise. Like the warm-up, this period helps to minimize muscle fatigue after exercise and allows the body to gradually return to a resting state.

Approximately 20 additional minutes should be added to an exercise training program to provide for adequate warm-up, stretches, and cool down after exercise.

***DO NOT** engage in vigorous exercise when you have a fever, a bad cold or flu. Also, when you are recovering from any illness, begin to exercise slowly and avoid heavy exercise until you are well.*

Sample Exercise Programs

- Look at your regular daily routine and increase effort in all wheeling activities and increase the frequency of wheeling to gradually increase daily exercise tolerance. This general increased daily activity will assist with weight control as well as gradually improving fitness.

- Include a muscle warm-up and stretching into daily routine. This enhances flexibility and minimizes muscle discomfort from the exercise program.

- Always warm-up muscles and perform stretches before exercise workouts.

- A larger muscle mass increases the potential for greater aerobic benefits. Improving strength of all upper limb muscles will increase aerobic ability.

1. Aerobic Conditioning

For those who cannot wheel for 5 minutes at a moderate to moderately hard effort:

The inability to wheel at a moderately hard sustained effort for 5 minutes is not uncommon for some people with quadriplegia who have a very low fitness level, a very small active muscle mass and/or who are overweight. In all cases a regular fitness program will significantly improve functional ability, help with weight control and provide general health benefits. Regular exercise needs to become a part of daily routine.

For the aerobic workout start with 3 days each week with interval endurance exercise. Interval training allows for short rest periods between exercise bouts. Wheel for as long as possible at a moderate to moderately hard effort, then rest for approximately one to two minutes. Repeat until 15 to 20 minutes of exercise has been completed. Ensure that you complete 15 to 20 minutes of exercise at the training intensity (no coasting). Gradually increase each workout until at least 5 minutes of continuous exercise is performed without a rest. After approximately 4 weeks, increase the length of the total exercise per day to 30 minutes and if a higher fitness level is desired workout for longer sessions.

After one to two months, allow 3 days for aerobic conditioning and add 2 days of strength training for a total of 5 days of exercise each week. Work out a schedule where

you do not exercise more than 3 days in a row without a rest day, and alternate strength and aerobic workouts. For example, keep Wednesday as a mid week rest day. Continue to stretch at least 5 days each week, preferably daily.

Do not be discouraged if it takes longer to progress than identified in this example. Many people with higher cervical cord injuries find that they can only wheel for 1-2 minutes without stopping or coasting when they first start an exercise program. This is not unusual and should not be a reason to say "I do not have enough muscles to take part in aerobic activities". The guidelines cited above may be followed by any person with quadriplegia who has enough muscle power to wheel a manual chair even for very short distances. Substantial gains will be made using a progressive interval training approach.

***For those who can wheel for 5 minutes or longer at a moderate to moderately hard effort*:**

For endurance training either interval (short rest periods during exercise session) or continuous exercise programs (no rest periods during exercise session) may be of benefit. Both interval and continuous endurance training have been shown to produce cardiovascular training benefits for people with quadriplegia. With an interval program what is most important is that rest periods are sufficiently short (1-2 minutes) as compared to exercise periods (5-10 minutes), that total exercise time is at least 20 minutes (but optimally 30 minutes or more), and training is at least 4 days each week.

Wheel in the moderately hard effort range, starting with 20 minutes each day and increasing to 30 minutes each day after the first month. Exercise at least 4 days each week if not also engaged in strength training. If you are involved in strength training, allow 3 days each week for your aerobic workout, and 2 days each week for your strength workout.

Many people with quadriplegia who have not exercised regularly find that they cannot exercise for 20 minutes at a moderate intensity without a rest. Start with whatever length of sessions you can manage. Rest for 1-2 min. between each session but continue working until you can complete a total of 20 minutes of exercise at the target intensity each exercise day. It may take 4-6 weeks to be able to workout for 20 minutes continuously each day at a moderate to moderately hard work effort. Once you can work out for 20 minutes each day, maintain that for one month and then increase workouts to 30 minutes each day and continue at 4 days each week for cardiovascular training benefits.

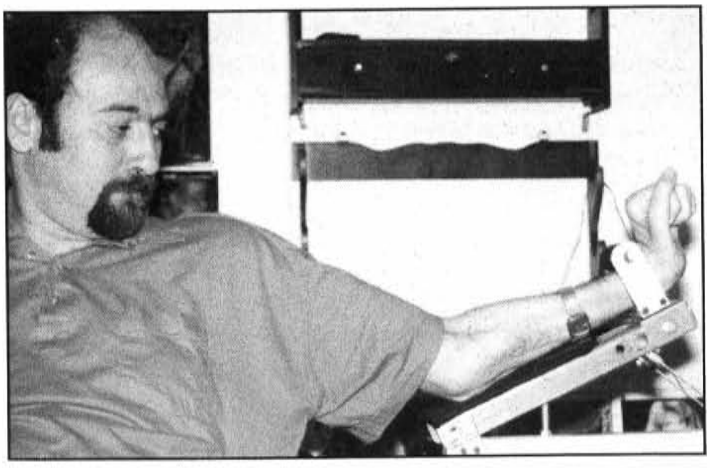
As you become fitter, you will have to work harder for the same "feeling" of work effort or workout for longer periods of time to gain further benefits. If the work feels easy you will most probably be achieving little, if any, further endurance training effects.

When progressing exercise workouts, DO NOT increase all parameters (intensity, length of training sessions, and days/week) at the same time. Progress slowly.

***Regular** strength and endurance training is needed to gain and to maintain optimal health and fitness.*

2. Strength Training

To start strength training sessions, choose 5 different upper limb muscle exercises. Select the weight appropriate to each muscle group as per the guidelines on page 6. Start with 2 sets of 8 repetitions for each exercise. Continue for 2 to 3 weeks, and then gradually add 1 more repetition to each set, until 12 repetitions for each set may be accomplished without difficulty. For further progression, increase the weight used or add another set (do not increase weight and add another set at the same time). Progress slowly.



Injury Prevention

- *Warm-up*
- *Stretch*
- *Maintain good upper limb strength and endurance*
- *Progress exercise program slowly*
- *Watch for signs of overload and overuse such as pain, and/or tenderness.*

People with quadriplegia are at greater risk of muscle and tendon injury than people with lower cord injuries as fewer muscles are available to meet daily functional demands, and muscle weakness and muscle imbalances in the upper limb muscles are more common. People with spinal cord injuries are also more prone to repetitive strain injuries to the upper limb.

Special attention should be paid to warm-up, stretching, and maintaining good upper limb strength and endurance. Also, maintain optimum body weight and pay close attention to signs of overuse or overload. If undue discomfort is felt during or after exercise or during any activity, adjust your program and activities to prevent further injury. Most minor muscle or tendon injuries resolve with rest in a few days. If an injury is more severe, does not resolve within a few days of rest, or is recurrent, seek advice from a qualified health professional. Early intervention and education on how to avoid re-injury will assist in recovery and minimize recurrence.

Temperature Regulation

Damage to the nervous system following a spinal cord injury alters the effectiveness of the body to maintain core body temperature. With complete spinal cord injury no sweating or shivering occurs below the injury level. Body temperature then rises and falls with environmental temperature, which makes a person with quadriplegia much more susceptible to overheating (hyperthermia) and overcooling (hypothermia).

Care should be taken to avoid overheating or overcooling when exercising in either very hot and humid, or very cold environments.

In Hot Humid Weather:

- *Drink plenty of liquids*
- *Cool the skin through the use of a fan and/or a water mist which promotes evaporative cooling*
- *Avoid heavy exercise*

Nutrition

"You are what you eat!"

Diet affects the general health of all body tissues. A poorly balanced diet means that exercise ability and recovery from exercise will be impaired.

- *Carbohydrates are needed for energy*
- *Fibre promotes regular bowel function*
- *Adequate fluids minimize urinary tract infections and prevent dehydration*

Adhere to the basic principles advocated for everyone. For example, a diet high in complex carbohydrates, low in fats, and containing adequate protein and fiber.

Minimum caloric intake requirements vary widely amongst individuals with quadriplegia and depend to a large extent on activity level. However, loss of voluntary muscle activity in the large leg muscles means less calories are needed. The smaller arm muscles use less calories than the legs did during exercise. Following caloric requirement standards set for able bodied people will generally result in increased weight gain.

A diet equal to approximately 50-75% of the intake prior to injury is a good guideline to follow.

People with quadriplegia should consume 5 - 8 servings of fruit and vegetables each day and 5 - 10 servings of whole grains. This will meet the carbohydrate requirements and ensure adequate fiber intake. Increasing fiber intake is important for regular bowel function. (Examples of 1 serving are a 1/2 cup of juice, a medium sized apple or banana, 1/2 cup of vegetables, and a single slice of bread.; 1 cup of rice or pasta equals 2 servings). For more information consult a registered dietitian.

Adequate fluid intake is important to minimize urinary tract infections and to prevent dehydration. Frequent urination or catheterization and dilute urine are the best indicators of adequate fluid intake. During exercise, drink approximately ¼ - ½ cup of fluid every 20 minutes. Water, dilute fruit juice or sports drinks are appropriate.

Many individuals with quadriplegia have deficient diets. To be able to exercise, muscles must have fuel (carbohydrates and fats). There is evidence that a diet deficient in carbohydrates may impede exercise ability and deplete muscles of glycogen (carbohydrate) stores. This results in earlier fatigue during exercise than would occur if the diet was high enough in carbohydrates. Sufficient available carbohydrates also "prime" the use of fats as a fuel for exercising muscles. Fats are an important fuel for longer duration exercise.

Optimal body composition means ***less fat and more muscle!***

Diet alone is NOT enough!

Many people with quadriplegia find that smaller, more frequent meals each day, and drinking fruit juices before and during exercise provides more energy, and minimizes feelings of fatigue.

Weight Control

Weight control is best achieved by both an active lifestyle and a well balanced diet where caloric intake equals caloric output through activity.

Lower fat weight is important for general health, for decreased risk of heart attack and stroke, and for improved exercise performance.

Being overweight adds considerable strain to upper limb muscles and tendons during transfers and weight shifts throughout a lifetime.

Seek advice from a qualified health professional if diet and weight control are of concern.

Obesity

- *increases the risk of pressure sores*
- *is a risk factor for many chronic illnesses*
- *increases the work of breathing*
- *increases the work for the heart*
- *increases the load on the upper limbs during all activities requiring weight shifts. This increases the risk of both acute and chronic muscle, tendon, ligament or joint injuries.*

Lifestyle and Lifespan

It is not necessary to "take time out" of one's regular schedule to exercise **IF** sufficient exercise can be included in normal activities. Individuals should consider their current lifestyle and see how increased activity could be included in their daily routine. For example, a person can wheel to work morning and/or night; or take time on lunch break to exercise; do warm-up exercises and stretch every morning. Include exercise in leisure activities.

Exercise needs to be integrated into an individual's regular lifestyle for optimum health and wellness.

People who maintain the highest fitness levels have the least medical complications from all causes, the least physician visits, and the least hospitalizations.

People with quadriplegia are living longer more active lifestyles. With aging comes the normal increased prevalence of musculo-skeletal injury and many other diseases. In particular, heart attacks and strokes from narrowing of the arteries are more common with increased age. Heart attacks are becoming the major cause of death and disability for people with spinal cord injury as they age. Further, there is some evidence that heart disease may appear at a younger age in spinal cord injured people as compared to the able bodied population.

Regular exercise, and a balanced diet are the keys to a healthier lifestyle.

There are "good fats" in the blood called high density lipoproteins (HDL's) which protect against narrowing of the arteries; and there are "bad fats" called low density lipoproteins (LDL's) which are thought to increase narrowing of arteries. Exercise increases the ratio of "good fat" (HDL) to "bad fat" (LDL) in the blood and thereby decreases the risk of heart and blood vessel disease. Blood lipid (fat) levels are abnormal in people with spinal cord injuries early post injury but improved values have been found in people who undergo endurance training, and normal values have been observed in wheelchair athletes.

Higher fitness levels are associated with less risk of heart disease, better weight control and improved blood lipid profile.

Wheelchair mobility places high demands on the upper limb muscles, joints, tendons and ligaments. There is growing concern over musculo-skeletal injury with aging for individuals who use wheelchairs. Upper limb injury can be very debilitating and can severely limit lifestyle. Maintaining an active lifestyle with strong endurance trained muscles is the best protection.

Avoiding, or minimizing the number of high stress maneuvers throughout life, such as transfers in and out of a car or truck with very unequal heights, and seeking early treatment for injuries will minimize problems with aging.

Tendons and ligaments lose their elasticity with age. Adequate warm-up, stretching and a realistic progression of activity will avoid unnecessary injury.

Aging is often associated with muscle weakness, more from a lack of regular activity than from the aging process itself.

Community Resources

Canadian Paraplegic Association
1101 Prince of Wales Drive, Suite 320
Ottawa, Ontario, K2C 3W7
(613) 723 - 1033

Consult your nearest CPA office for assistance in identifying local health professionals, and local wheelchair accessible exercise facilities.

Canadian Wheelchair Sport Association
1600 James Naismith Drive
Gloucester, Ontario.
(613) 748-5685

All of the provinces and territories have a wheelchair sport association. Your local association may be consulted to access sports, recreation and fitness facilities which have wheelchair accessible exercise equipment or programs.

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RICK HANSEN
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