

The Role of Physiatrist in the Diabetes Healthcare Team

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Abstract

The physiatrist is an important member of the diabetes healthcare team. His/her primary role is to provide physical activity counselling for the diabetics after thorough evaluation. Exercise is a primary component of diabetes management together with diet plan and antidiabetic drugs. The physiatrist, with his/her background knowledge in exercise physiology, is the most appropriate person for this job. Regular exercise has been shown to improve blood glucose control, reduce cardiovascular risk factors, contribute to weight loss and improve well being. Furthermore, regular exercise may prevent type 2 diabetes in high risk individuals. Thus physical activity plays a pivotal role in health promotion and diabetes control. People with diabetes should be advised to perform at least 150 minutes per week of moderate intensity aerobic physical activity using 'FITT Principle'. In the absence of contra-indications, people with type 2 diabetes should be encouraged to perform resistance training three times per week. DeLorme resistance exercise improves power, strength, endurance and burns more calories. Cross training is the term used to describe the use of a variety of activities during exercise. Interval training is the variation of intensity during one or more aerobic activities. Circuit training is the combination of aerobic exercise and weight training (anaerobic exercise). Before recommending a programme of physical activity, the physiatrist should assess diabetics for coronary artery disease and other complications of diabetes.

Key words: 'FITT Principle', DeLorme resistance exercise, cross training, interval training, circuit training.

Introduction:

Exercise is an important part of the diabetes management plan¹. Regular exercise has been shown to improve blood glucose control, reduce cardiovascular risk factors, contribute to weight loss, and improve well-being². Furthermore, regular exercise may prevent type 2 diabetes in high-risk individuals³⁻⁵. Structured exercise interventions of at least 8 weeks' duration have been shown to lower glycosylated haemoglobin (HBA1C) by an average of 0.66% in people with type 2 diabetes⁶. Higher levels of exercise intensity are associated with greater improvements in A1C and in fitness⁷. Other benefits include increased sensitivity to insulin and improved

blood glucose control⁸ and potential for decrease in diabetes medications needed to control blood glucose. Exercise may reduce blood lipids (total cholesterol, LDL cholesterol and triglycerides) and increase HDL cholesterol. Exercise may lower blood pressure⁹. Weight loss and maintenance can occur when exercises are combined with healthy eating habits. Exercise may be as effective as some psychotherapies in treating depression^{10,11}. Another study showed positive effects of exercise on hospitalized depressed patients, with regular aerobic exercise having an antidepressant effect¹². The collateral benefits of exercises are the patients often notice energy throughout the day, improved stress management, promotion of psychological well-being and increased quality of life. Thus physical activity is considered as a therapeutic tool in a variety of patients with or at risk for diabetes. The physiatrist, with his background knowledge in exercise physiology, is the most appropriate person for evaluating and prescribing exercises to the diabetics¹³.

Review of Literature:

Review of literature reveals that diet and exercise interventions in those with impaired glucose tolerance may delay the development of type 2 diabetes¹. There are 3 studies to support this statement. They are FINNISH Study¹⁴, Diabetes Prevention Program (DPP)¹⁵ and Da

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Qing Study¹⁶. In all these studies, the individuals with impaired glucose tolerance (IGT) were randomised to either a usual care control group or intensive life style intervention group. The control group received general dietary and exercise advice at baseline and had an annual physician's examination. The subjects in the intervention group received additional individualised dietary counselling from a nutritionist. They were also offered circuit-type resistance training sessions and advised to increase overall physical activity. The intervention was most intensive during the first year, followed by a maintenance period. The intervention goals were to reduce body weight, reduce dietary and saturated fat, and increase physical activity and dietary fibre. At the end of these studies it was found out that the intervention group showed significantly greater improvement in each intervention goal like weight reduction, glycaemic control and improved lipid level². So it was concluded that the intensive lifestyle intervention produced long-term beneficial changes in diet, physical activity, and clinical and biochemical parameters and reduced diabetes risk.

Evaluation of the Diabetics before recommending an Exercise programme - before recommending an exercise programme, the individual with diabetes mellitus should undergo a detailed medical evaluation and appropriate diagnostic studies by the psychiatrist. This examination should carefully screen for the presence of macro- and micro vascular complications that may be worsened by the exercise programme. Identification of areas of concern will allow the design of an individualised exercise prescription that can minimise risk to the patient.

Exercise prescription :

After thorough evaluation, exercise is prescribed for the diabetics. "FITT Principle" is being followed to prescribe exercise to the diabetics¹⁷. The acronym 'FITT' stands for Frequency, Intensity, Time and Type of exercises.

The U.S. Surgeon General's report¹⁸ recommended that most adults accumulate at least 30 minutes of moderate intensity activity on most, ideally all, days of work (frequency). They must carry out physical activity at the intensity of 50 - 70 % of maximum heart rate¹⁹. This is called target heart rate (intensity). The target heart rate is the rate at which the diabetics should aim to exercise. To calculate the maximum heart rate, the diabetic has to subtract his/her age from 220. Multiply the maximum

heart rate by 0.50-0.70 will give the target heart rate²⁰. The physical activity period must be approximately 60 (time) minutes which includes a warm up period of 5-10 minutes before the exercise session and a cool-down period of 10 minutes towards the end of the exercise session. The physical activity recommended is aerobic exercises (type).

Warm up (preliminary exercise)²¹: A standard recommendation for diabetic patients, as for nondiabetic individuals, is that physical activity includes a proper warm-up and cool-down period. A warm-up should consist of 5 – 10 minutes of aerobic activity (walking, cycling, etc.) at a low intensity level. The warm-up session is to prepare the skeletal muscles, heart, and lungs for a progressive increase in exercise intensity. After a short warm-up, muscles should be stretched for another 5-10 minutes, primarily, the muscles used during the active physical activity session, but warming up all muscle groups is optimal. The active warm-up can either take place before or after stretching.

There are two types of warm-ups.

General warm up: This type of warm up includes stretching, and general body movements or loosening up exercises that are unrelated to the specific neuromuscular actions of the anticipated performance.

Specific warm up: This type of preliminary exercise provides a skill rehearsal for the actual activity in which the participant is preparing. Practising tennis, playing football and performing preliminary lead up in the high jump or pole vault are examples of specific warm-up.

Cool down^{22, 23} : Moderate exercise, the practice of continuing to walk or jog at a slow pace, after strenuous exercise is called cool down. This facilitates blood flow through the vascular circuit including the heart and prevents venous stasis in the lower extremities during recovery and thereby prevents syncope. The cool-down period gradually brings the heart rate down to its pre-exercise level. The cool down period should last about 5 – 10 minutes.

Resistance exercise :

Resistance exercise improves insulin sensitivity to about the same extent as aerobic exercise²⁴. Clinical trials have provided strong evidence for the A1C lowering value of resistance training in older adults with type 2 diabetes^{25, 26} and for an additive benefit of combined aerobic and resistance exercise in adults with type 2 diabetes²⁷. If resistance is applied to a muscle as

it contracts, the muscle will adapt and become stronger over time. As the strength of a muscle increases, the cardiovascular response of the muscle improves so that muscular endurance and power also increases. To determine how much weight a person should use when beginning a resistance exercise programme, first the person's repetition maximum (RM) is found out. A RM is the greatest amount of weight (load) a muscle can move through the range of motion a specific number of times. For beginners, it is recommended a base line of 6 RM to 10 RM.

DeLorme developed the term Progressive Resistive Exercise to describe his approach to strengthen exercise²⁸⁻³⁰.

- First determine the 10 RM
- The person then carries out
 - o 10 repetitions at one half of the 10 RM
 - o 10 repetitions at three-fourths of the 10 RM
 - o 10 repetitions at the full 10 RM

The person has to perform all three bouts at each exercise session with a brief rest between bouts. The amount of weight is increased weekly as strength increases. The resistance exercise increases the strength, endurance, power and burns more calories.

General Exercise Tips to the Diabetics :

The diabetics are instructed to wear medical identification while exercising. They are advised to consider exercising with another person or a group, in case they need assistance. They have to keep blood glucose, food and exercise records to determine their overall response to exercise. The use of silicone gel or cotton polyester socks to prevent blisters and keep the feet dry is important for minimising trauma to the feet. Proper foot wear is essential and must be emphasised for people with peripheral neuropathy. Individuals must be taught to monitor closely for blisters and other potential damage to their feet both before and after physical activity. They have to drink plenty of water before, during and after exercise to avoid dehydration - 250 ml every 15 minutes or one litre of fluid per hour is recommended³¹. They have to set aside the same time each day for the exercise and make it a habit. They have to choose a time that does not coincide with the peak action of insulin. They are instructed not to inject insulin into an area that is contracting during the exercise. For example, if running, do not inject into the legs; if weight lifting, do not inject into the arms.

Insulin Adjustments :

The risk for hypoglycaemia is less when the level of insulin in the body is lower. The diabetics must avoid planning exercise programme for the time when the insulin is peaking. They have to avoid exercise for 1-2 hours after injecting rapid or short acting insulin. They have to plan exercise session before the morning insulin dose or 1-3 hours after eating. The risk for nocturnal hypoglycaemia is greater when exercise is performed in the evening. Reducing the evening insulin dose helps decrease the risk. Reducing insulin doses is particularly helpful for those who exercise routinely as part of weight management and or to improve control.

Carbohydrate Adjustments :

The diabetics are instructed to exercise around the same time each day that will make planning insulin and snack changes easier and more consistent. The decision about whether to eat additional food or adjust medication is based on the goal for exercise. Carbohydrate replacement is most useful for unplanned exercise or exercise of long duration.

Exercise in the Presence of Non-optimal Glycaemic Control:

Hyperglycaemia: When people with type 1 diabetes are deprived of insulin for 12–48 hours and are ketotic, exercise can worsen hyperglycaemia and ketosis; therefore, vigorous activity should be avoided in the presence of ketosis.

Hypoglycaemia: In individuals taking insulin and/or insulin secretagogues, physical activity can cause hypoglycaemia if medication dose or carbohydrate consumption is not altered. For individuals on these therapies, added carbohydrate should be ingested if pre-exercise glucose levels are 100 mg/dl. Hypoglycaemia is rare in diabetic individuals who are not treated with insulin or insulin secretagogues, and no preventive measures for hypoglycaemia are usually advised in these cases.

Exercise in the Presence of Specific Long Term Complications of Diabetes:

Retinopathy: In the presence of proliferative diabetic retinopathy (PDR) or severe non-proliferative diabetic retinopathy (NPDR), vigorous aerobic or resistance exercise may be contra-indicated because of the risk of triggering vitreous haemorrhage or retinal detachment³².

Peripheral neuropathy: Decreased pain sensation in the extremities results in increased risk of skin breakdown and infection and of Charcot joint destruction. Therefore, in the presence of severe peripheral neuropathy, it may be best to encourage non-weight bearing activities such as swimming, bicycling, or arm exercises^{33,34}. All individuals with peripheral neuropathy should wear proper footwear and examine their feet daily to detect lesions early.

Autonomic neuropathy: Autonomic neuropathy can increase the risk of exercise induced injury or adverse event through decreased cardiac responsiveness to exercise, postural hypotension, impaired thermoregulation, impaired night vision due to impaired papillary reaction, and unpredictable carbohydrate delivery from gastroparesis predisposing to hypoglycaemia³⁵. Autonomic neuropathy is also strongly associated with CVD in people with diabetes^{36,37}.

Albuminuria and nephropathy: Physical activity can acutely increase urinary protein excretion. However, there is no evidence that vigorous exercise increases the rate of progression of diabetic kidney disease, and there is likely no need for any specific exercise restrictions for people with diabetic kidney disease³⁸.

Cross training- The term cross training refers to a training routine that involves several different forms of exercise. For example, using both biking and swimming each week to improve overall aerobic capacity, build overall muscle strength and reduce the chance of an overuse injury. Cross training is a great way to condition different muscle groups, develop a new set of skills, and reduce boredom that creeps in after months of the same exercise routines.

Interval training- Interval training is a type of physical training that involves bursts of high-intensity work interspersed with periods of low-intensity work. The high-intensity periods are typically at or close to near-maximum exertion, while the recovery periods may involve either complete rest or activity of lower intensity. It is a technique particularly employed by runners. However, it is also applicable to exercisers as it helps improve exercisers' aerobic capacity to exercise longer at varying intensities. This method of training may be more effective at inducing fat loss than simply training at a moderate intensity level for the same duration. A significant amount of high intensity work can be achieved with interval or intermittent work if there is appropriate spacing of the work relief intervals. The total amount of work than can be completed with

intermittent work is greater than the amount of work that can be completed with continuous training³⁹⁻⁴¹.

Circuit training^{42, 43} is a form of combining resistance training and high-intensity aerobics. It is designed to be easy to follow and target strength building as well as muscular endurance. An exercise "circuit" is one completion of all prescribed exercises in the programme. When one circuit is complete, one begins the first exercise again for another circuit. Traditionally, the time between exercises in circuit training is short, often with rapid movement to the next exercise.

Physical Activity Recommendations⁴⁴:

- People with diabetes should be advised to perform at least 150 minutes/week of moderate-intensity aerobic physical activity (50–70% of maximum heart rate).
- In the absence of contra-indications, people with type 2 diabetes should be encouraged to perform resistance training three times per week.

Conclusions:

The recent Surgeon General's Report on Physical activity and Health underscores the pivotal role physical activity plays in health promotion and disease prevention. It recommends that individuals accumulate at least 30 minutes of moderate physical activity on most days of the week. In the context of diabetes, it is becoming increasingly clear that the epidemic of type 2 diabetes sweeping the globe is associated with decreasing levels of activity and an increasing prevalence of obesity. Thus, the importance of promoting physical activity as a vital component of the prevention as well as management of type 2 diabetes must be viewed as a high priority. Ultimately, all persons with diabetes should have the opportunity to benefit from the many valuable effects of physical activity prescribed by the physiatrist.

What We Already Knew:

- Exercise is a primary component of diabetes management together with diet plan and anti-diabetic drugs.

What We Learn from This Article:

- Exercise prescription method to diabetics – "FITT Principle"
- DeLorme's Progressive Resistive Exercises – Repetition Maximum (RM)

- Exercises to be avoided in presence of long term complications of diabetes
- Cross training, interval training, and circuit training

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