

## **The Value of Exercise Training in Severely Ill Adult CF Patients**

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Physical activity and exercise training are known to have a positive influence in patients with CF and have become an important part of the overall treatment package. Benefits include increased cardio-respiratory fitness, increased muscle strength, improved ventilatory efficiency, maintenance of fat-free-mass and bone mineral density, improved psychological wellbeing, improved quality of life, and longer survival.

However, the usefulness of exercise training is not only restricted to healthier patients with CF (who tend to have a more normal exercise response and capability), but has many potential benefits for those patients with more advanced lung disease - even where the disease has progressed to the stage where they have been referred for lung transplantation.

Many patients with CF present for lung transplantation with a high degree of physical “de-conditioning” as a result of disuse through inactivity and general disease progression. Furthermore, post transplantation; the subsequent immunosuppressive medication may have an added negative impact on skeletal muscle structure and function. This is likely due to atrophy of the quadriceps caused, in part by corticosteroid therapy and possible decreases in skeletal muscle mitochondrial respiration (Pinet et al, 2004; Hokanson et al 1995). It seems prudent therefore, that exercise training forms a major part of the pre and post-transplant rehabilitation program.

Such de-conditioned patients are often those with more advanced disease, who tend to be underweight and inactive, with a poor exercise tolerance. How much of the poor exercise



tolerance is due to the limitations of the disease and how much is due to reversible de-conditioning of the skeletal muscles is something we are interested in, especially in those referred for transplantation. If exercise tolerance could be increased in these patients, despite other limitations, then their outlook both during the wait for a transplant and during rehabilitation might be improved. Furthermore, the introduction of a program of regular, supervised exercise training prior to lung transplantation could help optimize the patient's physical condition.

We therefore offered such patients the opportunity to attend a supervised exercise training program (including exercise modes, intensities and volumes tailored to each individual's requirement) at our CF centre. A typical exercise session would consist of a warm-up and stretch followed by cardio-respiratory exercise training, supplemented with resistance training, flexibility and postural work. The supervised exercise was supplemented with independent exercise performed by the patient at home between sessions.

Of 8 patients referred for enrolment, 3 declined to attend: 2 of these 3 were unwilling or unable to travel and 1 refused to exercise. Following enrolment, of the five who remained, 1 patient attended for over a year before receiving a transplant and then attended for rehabilitation; 1 patient attended for a 3 week period before receiving a transplant and has subsequently attended for rehabilitation; 2 patients attended (for 7 and 43 weeks respectively) but unfortunately died before receiving a transplant; 1 has attended for over 21 weeks and is still awaiting transplantation. Of those that were initially unwilling or unable to attend, 2 have received transplants and 1 has been de-listed.

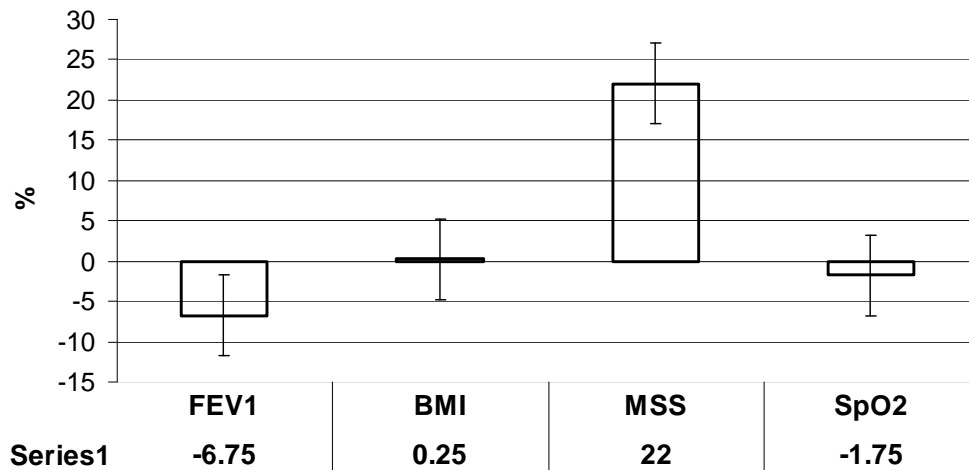
We recorded lung function (% predicted FEV<sub>1</sub>), nutritional status (BMI), maximal steady state treadmill speed (MSS) and oxygenation saturation (%SpO<sub>2</sub>) during the program. We used MSS to represent exercise capacity as it approximates anaerobic threshold which is a good indicator of practical functional capability. This is important when assessing how well a patient is managing in their day to day activities.

An individualised treadmill protocol was devised to determine MSS for each patient, with an increase in walking speed at 2-3 minute intervals, starting with relatively large speed



increments at the beginning of the test, decreasing as their maximal sustainable pace was approached. When the patient felt they had reached their best sustainable pace, they were then asked to maintain this for a minimum of 4 minutes. SpO<sub>2</sub>, heart rate and objective/subjective measures of breathlessness and fatigue were recorded throughout. The results suggest that even when nearing the end stage of the disease, patients can still increase their exercise capacity with increases in MSS despite decreases in lung function, exercise oxygen saturation & nutritional status (Fig 1).

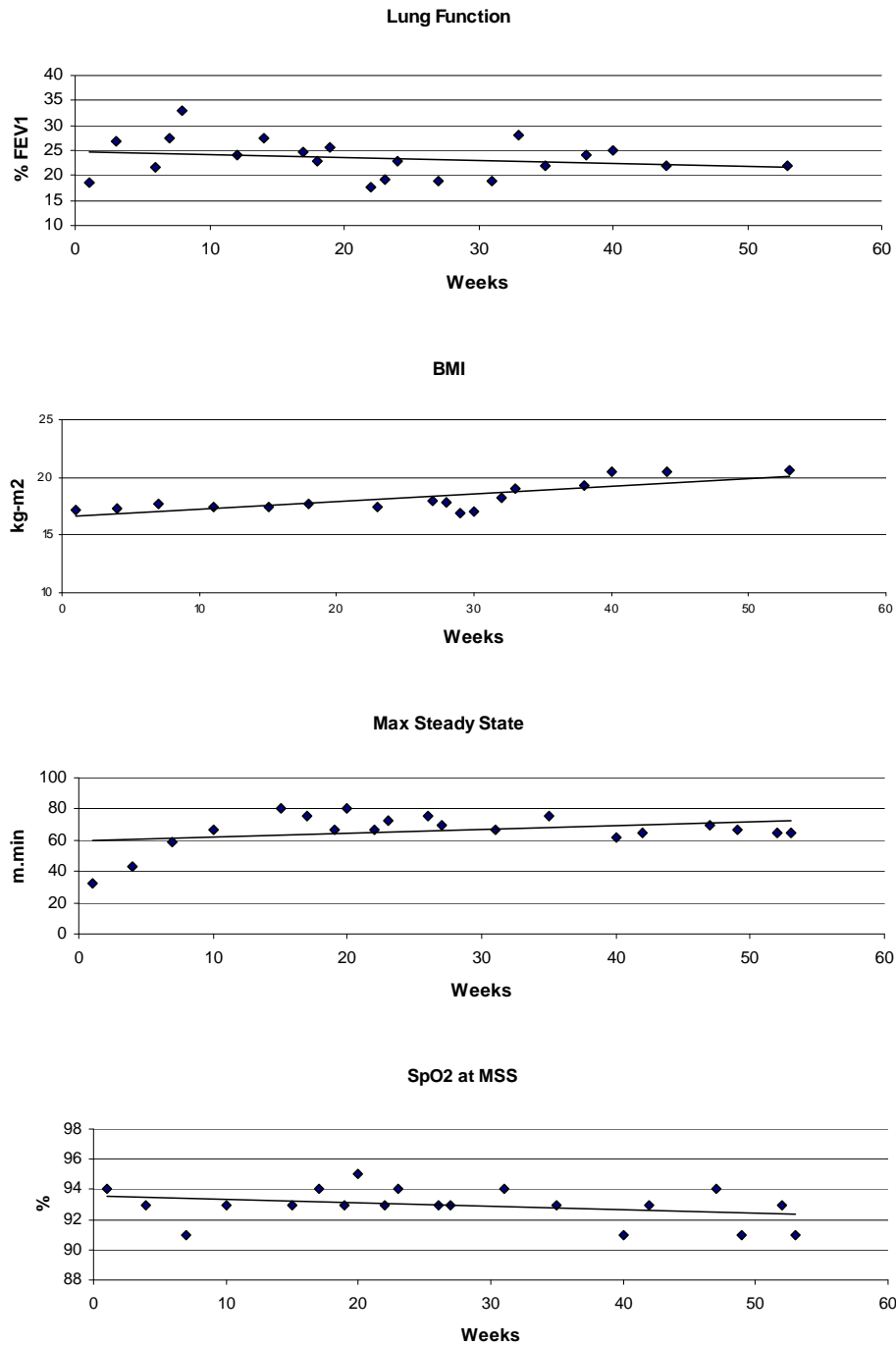
**Fig 1. Average changes in variables during the pre-transplant phase**



The patients showed an increased exercise capacity from the outset, levelling to a plateau maintained throughout the pre-transplant period. (Figure 2 shows typical data recorded for lung function, BMI, exercise capacity and exercise oxygen saturations of a sample patient tracked over the course of their pre-transplant exercise program). The general trend of the variables over time were; a ‘learning curve’ increase in exercise capacity with other variables slowly declining, suggesting that there was reversible de-conditioning prior to commencing exercise training. Over time, exercise capacity decreased in line with other physical variables suggesting that fitness had been optimised.



**Fig 2 Data recorded over the pre-transplant exercise period for patient A.**





Two patients who attended for prolonged periods obtained an improvement in functional capacity and their families noted increased motivation and support.

We have had success in helping previously inactive patients (and their families) adopt an active lifestyle, whether it being to re-discover a lost interest in exercise or to train and inculcate exercise values in people who had never been active before. In many cases the patients have gone on to independently manage their own exercise, requiring only occasional 'refreshers' from the exercise team or reviews at regular clinic appointments to remain motivated to continue.

The encouragement of an active lifestyle helps our patients cope with their disease, allowing them to participate more fully in peer and family activities and ultimately improving their quality of life.

## **References**

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