THE EFFECTS OF PROGRESSIVE HANDGRIP TRAINING ON ARTERIOVENOUS FISTULA MATURATION IN CHRONIC KIDNEY DISEASE – A PILOT RANDOMISED CONTROLLED TRIAL

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INTRODUCTION: The arteriovenous fistula (AVF) is considered the gold standard for haemodialysis access. However, many fail to mature for usage owing to complications such as stenosis and thrombosis. Maturation is known to occur in response to increases in blood flow. Although supporting empirical evidence does not exist, performing regular forearm exercise post-operation has been recommended in the K/DOQI guidelines to aid maturation. Our aim was to complete a pilot study to determine the effectiveness of a post-operative progressive handgrip exercise program in improving fistula maturation (and success) by measurement of effect sizes (ES). It was hypothesised that subjects randomly allocated to the training group would demonstrate significantly greater increases in blood flow and diameter of the artery and vein involved in AVF creation. Furthermore, it was expected that the training group would show a reduced period of maturation and a smaller incidence of failure. The data obtained would be useful in planning future large-scale trials.

METHODS: Eight CKD patients attending AVF surgery were recruited. Subjects randomly assigned to the exercise group were prescribed an 8 week exercise program consisting of 30 minutes of forearm exercise 4 times per week. This initially involved a ‘squeezy ball’ and progressed to a handgrip device that permitted further increases in intensity. The control group received routine care without introduction of a ‘squeezy ball’. Diameter and flow measurements of the vein and artery were taken using Doppler ultrasound at post-operation days 1, 28 and 56. Assessments of maximum handgrip strength and forearm muscle circumference took place pre-operatively and were re-assessed at days 28 and 56. Experienced nursing staff clinically defined time to maturation and success or failure. The magnitude of the effect of the exercise intervention was determined by utilising change scores in the calculation of ES with values of .20, .50, and .80 indicating small, medium and large effects, respectively.

RESULTS: The ES calculated using diameter change scores indicated accelerated arterial remodelling in the exercise group only in the first half of the study (1 to 28 days, ES = 1.54; 28 to 56 days, ES = -0.5). The exercise intervention throughout had a small effect upon the change in venous diameter (1 to 56 days; ES = 0.2). Blood flow measurements were deemed unsuitable for valid assessment and thus excluded. The exercise intervention had large effects on the change in maximum handgrip strength and forearm muscle circumference, with overall ES of 0.91 and 0.84, respectively. Maturation time, success or failure and complications were similar in both groups.

CONCLUSION: The present study represents the first randomised, controlled trial of a handgrip exercise intervention on AVF maturation. The ES obtained so far justifies future trials. Although a definite conclusion regarding the K/DOQI guidelines is awaited from a larger study, our results suggest that an intensive exercise regime may have a positive effect on venous maturation through increased venous diameter. This may permit earlier and successful needling of AVFs.