THE EFFICACY OF HOME BASED EXERCISE REGIMES FOR LIMB OEDEMAS

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DECLARATION

I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.

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Summary

Both secondary lymphoedema and venous oedema of the limb are the consequence of an imbalance between tissue fluid infiltrate and drainage, which leads to interstitial fluid accumulation, tissue compositional changes, limb discomfort and morbidity. Numerous conservative therapies have been developed to address some of these negative outcomes, with a proportion of these being labour and cost intensive. This makes the investigation of cost effective and easy to implement home based regimes very important. One such therapy is limb exercise, which can be beneficial for limb oedemas through changes in both interstitial pressure and calf muscle activation. The potential benefits of exercise certainly justify further investigation to help determine it's viability as a self instigated therapy for limb oedemas.

A systematic review of existing conservative therapies (including limb exercise) revealed varying, and at times not very rigorous outcomes for those with limb oedemas. Some claims of treatment outcomes were quite startling, with a volume reduction of 652mls in one complex physical therapy study. In other studies the limb volume reductions were smaller, especially in the self maintenance therapies. All reviewed therapies that measured subjective limb symptoms found that these were improved, whether the participants were receiving active or placebo treatment. Studies which included a follow up period demonstrated that a form of additional therapy needed to be undertaken to maintain the initial improvements in limb volume and subjective symptoms. This also needs to be considered when determining the benefits of the reviewed therapies, as some require significant clinical and economic resources.

Four clinical trials were then conducted on three new exercise regimes for oedematous limbs. The first regime investigated leg elevation and passive exercise for lymphoedema and venous oedema of the legs. Both groups experienced a significant reduction in limb volume, weight, and reported skin dryness, pain, heaviness, tightness, limb size plus improvements in quality of life parameters such as depression and physical activities. Some improvements were also maintained at the one month follow up, most notably body weight, skin dryness and perceived limb size.

A 10 minute deep breathing plus arm exercise regime for secondary arm lymphoedema initially achieved reductions in arm volume, truncal fluid and perceived heaviness and tightness, with greater reductions in these parameters being achieved when this regime was performed over a 1 month period. A pilot study of combined deep breathing, self massage and sequential limb exercises for secondary arm and leg lymphoedema demonstrated a small volume reduction for those with arm lymphoedema but a greater reduction in those with leg lymphoedema. However, both groups experienced positive improvements in perceptions of limb heaviness, tightness and range of movement.

The limb reductions and improvements achieved by these exercise regimes were sometimes similar to and at other times greater then those obtained in previous exercise studies and existing conservative therapies administered by clinicians and/or the patient. The systematic review in combination with the clinical trials has demonstrated the multifaceted benefits of limb exercise, including limb volume reduction and improvements in subjective symptoms, limb function and quality of life issues. This makes exercise a cheap and easy to implement adjunct or alternative regime for those with limb oedemas.

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Introduction

Secondary lymphoedema and venous oedema of the limbs represent an imbalance between tissue infiltrate and drainage which resultant limb swelling, detrimental vessel and tissue changes and reduced quality of life. Surprisingly, these conditions effect a significant number of the population, with an estimated 30% of people developing secondary limb lymphoedema as a sequelae of cancer treatment (Williams, Franks & Moffatt 2005; Deo, Ray, Rath et al 2004), with chronic venous insufficiency and subsequent lower limb oedema affecting 4-5% of the population in developed countries (Stafa 2002; Fowkes, Evans & Lee 2001). These conditions have a personal and socioeconomic impact upon the individual and an economic impact upon the health care system, which treats not only the primary conditions, but also their co-morbidities (such as ulceration and cellulitis).

Therefore it is in the best interest of both the individual and the health care system to implement therapy to reduce the risk of these conditions developing and to halt their progression when they do occur. Unfortunately, universal access to effective and beneficial treatment for these conditions is currently not available. Globally, treatment access is reliant upon the resources each health care system can provide for treatment and the availability of suitably qualified clinicians who can both accurately diagnose and treat the conditions. Individually, access is reliant upon the person's time availability, financial resources and geographical location (for example, city versus rural living).

These access issues make the establishment of beneficial and cost effective home based treatment regimes very important. In particular, exercise can be cost effective and easy to undertake in the home environment and therefore a potentially very beneficial maintenance tool in both lymphatic and vascular limb swelling. Although exercise has been traditionally incorporated into overall therapy programs for limb oedemas, and has been shown to be beneficial in combination with complex physical therapy (Casley-Smith 1997; Swedborg 1980), compression and massage (Leduc, Peeters & Borgeois 1990; Olszewski & Engeset 1988), it's stand alone effects and benefits have only recently been explored.

This may partly be related to clinicians traditionally being hesitant in recommending exercise for those with limb oedemas, in the fear that the increased muscular blood flow would precipitate or exacerbate the oedema, not help it. However, research has demonstrated that strenuous exercise does not always exacerbate the pre-existing swelling or contribute to it's development (Turner, Hayes & Reul-Hirche 2004; McKenzie & Kalda 2003; Kahn, Azoulay, Hirsch et al 2001; Harris & Niesen-Vertommen 2000; Ciocon, Galindo-Ciocon & Galindo 1995). In fact, it has been shown that exercise changes interstitial tissue pressure and therefore has crucial benefits for limb oedemas. These benefits include increased lymph flow (Havas, Lehtonen, Vuorela et al 2000; Mazzoni, Coates, O'Brodovich & Goeree 1993; Skalak & Shönbein 1990) and transport of inflammatory proteins (Olszewski & Engst 1998; Havas, Parviainen, Vuorela et al 1997). Exercise also activates the calf muscle pump, which increases venous ejection fraction in those with lower limb oedema subsequent to chronic venous insufficiency (Padberg, Jrohston & Sisto 2004; Yang, Vandongen & Stacey 1998).

As patients with limb oedemas have variable access to conservative therapies, alternative or adjunct regimes that contribute to limb maintenance, are easy to implement and cost effective are most certainly needed. Considering previous research has shown that exercise maybe beneficial, both for oedema arising from lymphatic and/or vascular dysfunction, further research into new modalities that use exercise as their core component is warranted. Therefore, this thesis explores the benefits of different exercise regimes for limb oedema of both lymphatic and vascular origin. This is achieved through;

- An exploration of normal and detrimental lymphatic and venous flow in the limb and what occurs when the lymphatic and venous systems fail
- An exploration of the importance of accurate diagnosis, measurement and treatment of the oedematous limb
- A systematic review of commonly recommended conservative therapies for limb oedemas, including;
  - Complex physical therapy
  - Manual lymphatic drainage
  - Self massage
  - Compression (bandaging and garments)
  - Limb exercise
  - Limb elevation
  - Low level laser therapy
  - Pneumatic pump therapy
  - Oral Pharmaceuticals

- A comparison of the average percentage reduction achieved by the reviewed conservative therapies

- The presentation of four clinical trials which investigated the benefits of different exercise regimes for limb oedemas, including;

  - Limb elevation and passive exercise for secondary leg lymphoedema and venous oedema of the legs

  - Combined deep breathing and arm exercise for secondary arm lymphoedema

  - Instructed deep breathing, self massage and sequential limb exercises for secondary arm and leg lymphoedema

- A comparison of the percentage oedema reduction achieved by the new exercise regimes against the reductions achieved by previously studied exercise regimes.

- An exploration of the overall volume reductions and improvements in subjective symptoms, quality of life and range of movement achieved by the new exercise regimes in comparison with existing exercise regimes, self maintenance therapies and health professional administered therapies.