ARJOHUNTLEIGH
GETINGE GROUP

FLOWTRON HYDROVEN 3

DYNAMIC IPC THERAPY SYSTEM

…with people in mind

SIMPLE TO USE SYSTEM FOR ACTIVE THERAPY

As an internationally recognised brand, *Flowtron*® is a hallmark for quality, reliability and service excellence. The *Flowtron hydroven*™ *3* intermittent pneumatic compression (IPC) system provides clinically effective, non-invasive dynamic compression to the limbs to treat a wide variety of vascular and lymphatic conditions, including venous ulceration, dependent and traumatic oedema and chronic venous insufficiency.

Its flexible, ergonomic design offers the clinician a choice of single or three chamber compression from a variety of arm and leg garments operated by a single pump. Tried and tested ArjoHuntleigh technology means you can be assured it will deliver gentle, effective results every time.

The *Flowtron hydroven 3* system has been designed for efficient use in many different situations from the clinic to the home. The controls, indicators and connectors are simple to use and can be accessed with ease. Thoughtful design features mean the pump can be handled, transported and stored safely and easily.

- Secure single tube snap-lock connection of all garments to the pump promotes easy set up and prevents accidental disconnection.
- Automatic detection of single or dual garment attachment makes the system simple to set up. Just 'plug in and switch on' for active treatment of a range of conditions.
- Lightweight pump and ergonomically designed handle means convenient handling and transportation.
- Cable retention system ensures compact and easy storage whilst the pump is not in use.

Flexibility to meet your therapy needs

The *Flowtron hydroven 3* system offers the choice of three and single chamber leg or arm garments from a single pump and adjustable pressure control provides tailored therapy to suit individual patient needs.

- Unique inflatable insert pieces allow the system to be used on larger limbs, providing true circumferential compression without the extra cost of purchasing additional garments.
- Clever pump design means it can be orientated vertically or horizontally to allow the system controls to be easily accessed by patient, carer or clinician.

MAXIMUM PATIENT COMFORT - EFFECTIVE RESULTS

Patient comfort and concordance is synonymous with the *Flowtron* name. Both garments and pumps are designed to ensure maximum comfort while delivering clinically effective results.

- Lightweight yet durable leg and arm garments with a soft, pliable inner lining allowing inward expansion to massage all contours of the limb.
- Inflatable foot section on all leg garments ensures pressure is distributed gently around the entire foot, eliminating toe pinching and improving patient concordance.
- Large ring pull zip ensures easy application and removal of garments when mobility or dexterity is restricted.
- Quiet, vibration-free pump minimises disturbance, encourages patient concordance and means the system can fit comfortably into patients' lifestyles.

Hydroven 1 garments

- Single chamber arm and leg garments for uniform compression.
- Can be used with *hydroven* insert pieces.
- Single tube snap-lock connection for simple set up.

Hydroven 3 garments

- Three chamber arm and leg garments provide gradient sequential compression.
- 10% reduction in pressure in each chamber distally to proximally.
- Can be used with *hydroven* insert pieces.
- Single tube snap-lock connection for simple set up.

Hydroven insert pieces

- Single chamber inflatable expansion inserts to increase the circumference of leg or arm garments for larger limbs, while providing true circumferential compression around the contours of the limb.

Insert pieces for larger limbs

Simple to use controls.

Secure single tube snap-lock connection

3 chamber garments provide gradient sequential compression

PRODUCT SPECIFICATIONS

Flowtron hydroven 3 / Pump Specification	
Order Code	**510001**
Power	220 - 240V AC 50Hz
Size	270 x 140 x 140 mm (10⅔ x 5½ x 5½")
Weight	2.4 kg (5.5 lbs)
Pressure Range	30 - 100 mmHg
Cycle Time	90 seconds inflation; 90 seconds deflation

Ordering Information		
Code	**Product Description**	**Length**
5101L50	1 half leg garment	500 mm (19⅔")
5101L66	1 full leg garment	660 mm (26")
5101L71	1 full leg garment	710 mm (28")
5101L76	1 full leg garment	760 mm (30")
5101L84	1 full leg garment	840 mm (33")
5101L92	1 full leg garment	920 mm (36¼")
5101A51	1 half arm garment	510 mm (20")
5101A68	1 full arm garment	680 mm (26¾")
5101A78	1 full arm garment	780 mm (30⅔")
5103L50	3 half leg garment	500 mm (19⅔")
5103L66	3 full leg garment	660 mm (26")
5103L71	3 full leg garment	710 mm (28")
5103L76	3 full leg garment	760 mm (30")
5103L84	3 full leg garment	840 mm (33")
5103L92	3 full leg garment	920 mm (36¼")
5103A68	3 full arm garment	680 mm (26¾")
5103A78	3 full arm garment	780 mm (30⅔")
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510LI92	full leg insert piece	920 mm (36¼")
510AI68	full arm insert piece	680 mm (26¾")
510AI78	full arm insert piece	780 mm (30⅔")

Only ArjoHuntleigh designed parts, which are designed specifically for the purpose, should be used on the equipment and products supplied by ArjoHuntleigh.
As our policy is one of continuous development we reserve the right to modify designs and specifications without prior notice.

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GETINGE GROUP is a leading global provider of products and systems that contribute to quality enhancement and cost efficiency within healthcare and life sciences. We operate under the three brands of **ArjoHuntleigh**, **GETINGE** and **MAQUET**. **ArjoHuntleigh** focuses on patient mobility and wound management solutions. **GETINGE** provides solutions for infection control within healthcare and contamination prevention within life sciences. **MAQUET** specializes in solutions, therapies and products for surgical interventions and intensive care.

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RECOMMENDED PROTOCOL FOR USE

FLOWTRON HYDROVEN™ THERAPY

FOR WOUND HEALING, TISSUE REPAIR AND OEDEMA MANAGEMENT

…with people in mind

Introduction

The challenge of repairing bodily injury is complex and best understood as a cascade of events that under normal circumstance results in repair. In clinical practice however, healthcare professionals are frequently required to manage conditions of the limb that occur as a result of an underlying pathological process. Impaired blood supply and oedema are contributory factors in non-healing wounds.

The use of intermittent pneumatic compression (IPC) increases arterial, venous and capillary blood flow in the applied limb and can therefore expedite wound healing and tissue repair particularly in venous leg ulcers and surgical wounds. In addition it increases pressure in the extracellular space actively returning fluid back into the circulation thereby reducing oedema. There is emerging interest in new IPC applications including the management of mixed aetiology ulcers, peripheral arterial disease and as a modality to enhance cutaneous healing.

Flowtron Hydroven™ Systems for Active Therapy

ArjoHuntleigh offers a comprehensive range of IPC systems for the treatment of venous and lymphatic conditions. Each of the products in the *Flowtron Hydroven* range is safe, non-invasive and simple to use and provides clinicians with a natural solution for the management of these conditions.

Flowtron Hydroven 12 System

The *Flowtron Hydroven 12* System sets a new standard in the treatment of venous and lymphatic disorders. This ultimate high performance unit for use with Hydroven™ 12 chamber garments provides the clinician with a choice of dynamic inflation sequences, therapy cycles and treatment parameters providing optimal therapy conditions for individual patient care.

Flowtron Hydroven 3 System

The *Flowtron Hydroven 3* System offers the flexibility to be used with single (*Hydroven 1*) or three (*Hydroven 3*) chamber garments. This simple to use, lightweight pump with preset cycle times and adjustable pressure settings for individual comfort makes the *Flowtron Hydroven 3* System ideal for providing safe and effective gradient sequential compression therapy in the home as well as the clinic.

Purpose

Flowtron® therapy assists in oedema reduction and improved blood flow aiding the healing and tissue repair process.

Indications

Use of *Flowtron Hydroven* Systems in the management of patients with upper and lower extremity pathologies must be considered as part of overall holistic therapy. Flowtron therapy is proven to be effective in the following clinical conditions:

- Used alone or as an adjunct to compression bandaging on patients with venous disease. *Flowtron* therapy has been demonstrated to improve ulcer healing rates [1, 2] and prevent ulcer reoccurrence [1]
- Where conventional therapies such as bandaging have failed, where there is non-concordance [3-5] or where access to skilled compression bandaging is limited
- For mixed aetiology disease, the use of *Flowtron* therapy over reduced compression bandaging is effective [6]
- Reduction of oedema associated with venous and lymphovenous disease [7, 8]
- Rapid reduction of swelling in patients with ankle fractures enabling earlier operative treatment and enhanced long term functionality [9]
- Improved wound healing and patient comfort following vein harvesting as part of coronary artery bypass grafting [10]
- Effective healing of sports injuries [11]

Contraindications

Flowtron Hydroven Systems should not be used in the following conditions:

- Known or suspected deep vein thrombosis (DVT), pulmonary embolism, thrombophlebitis and acute untreated infections of the skin such as cellulitis
- Decompensated / severe congestive cardiac failure, pulmonary oedema associated with significant limb oedema or any condition where an increase of fluid to the heart may be detrimental

- Severe arteriosclerosis or other ischaemic vascular disease
- Active metastatic disease affecting the limb

Cautions

Flowtron Hydroven Systems should be used with care in patients with the following symptoms or conditions:

- Peripheral neuropathy, pain or numbness in the limb
- Undiagnosed, untreated or infected wounds, fragile skin, grafts or dermatological conditions that may be aggravated by the garment
- Extreme limb deformity which may practically impede the correct application of the garment

Guidelines for Use

These are guidelines only and should not replace clinical judgement or experience.

The *Hydroven* garment may be used on top of existing bandaging or applied directly to the limb.

Any wounds must be covered with an appropriate dressing. To protect the garment, application of a loosely fitting cotton stockinette is recommended. For maximum benefit, it is recommended that the patient sits or lies with their limb(s) elevated. *Hydroven* garments must be removed prior to mobilisation.

Venous Leg Ulcers

- Pressures of between 40-60 mmHg at the ankle are typically advised as these have been found to be most effective in clinical studies[1, 3-5, 12, 13]. Lower pressures are advised where the limb is hypersensitive or painful [5,13]
- Frequency is recommended between 1-2 hours once or twice daily [1, 3-5, 12, 13]

Oedema Reduction

- Optimum pressure settings are recommended at 30-40 mmHg 8, at a frequency of 45 minutes to 2 hours, once or twice daily

Rapid Reduction of Swelling Following Closed Ankle Fracture

- Optimum pressure settings are recommended at 40 mmHg [9]
- Therapy is recommended as soon as possible after injury and confirmation of diagnosis. Continuous therapy until surgery is recommended to effectively reduce oedema [9]

Enhancing Surgical Wound Healing

- Pressure settings are recommended at 30 mmHg [10]
- Frequency is recommended as 2 hours in the immediate post-operative period and 4 hours everyday thereafter until discharge [10]

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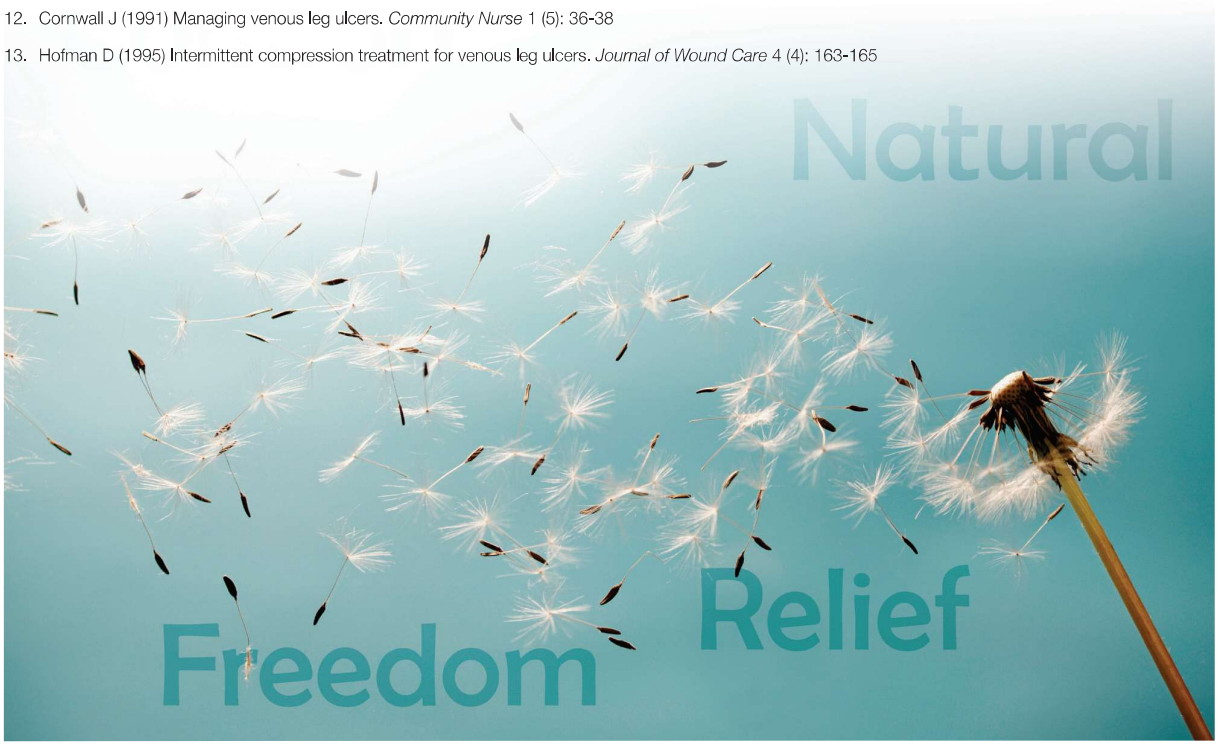

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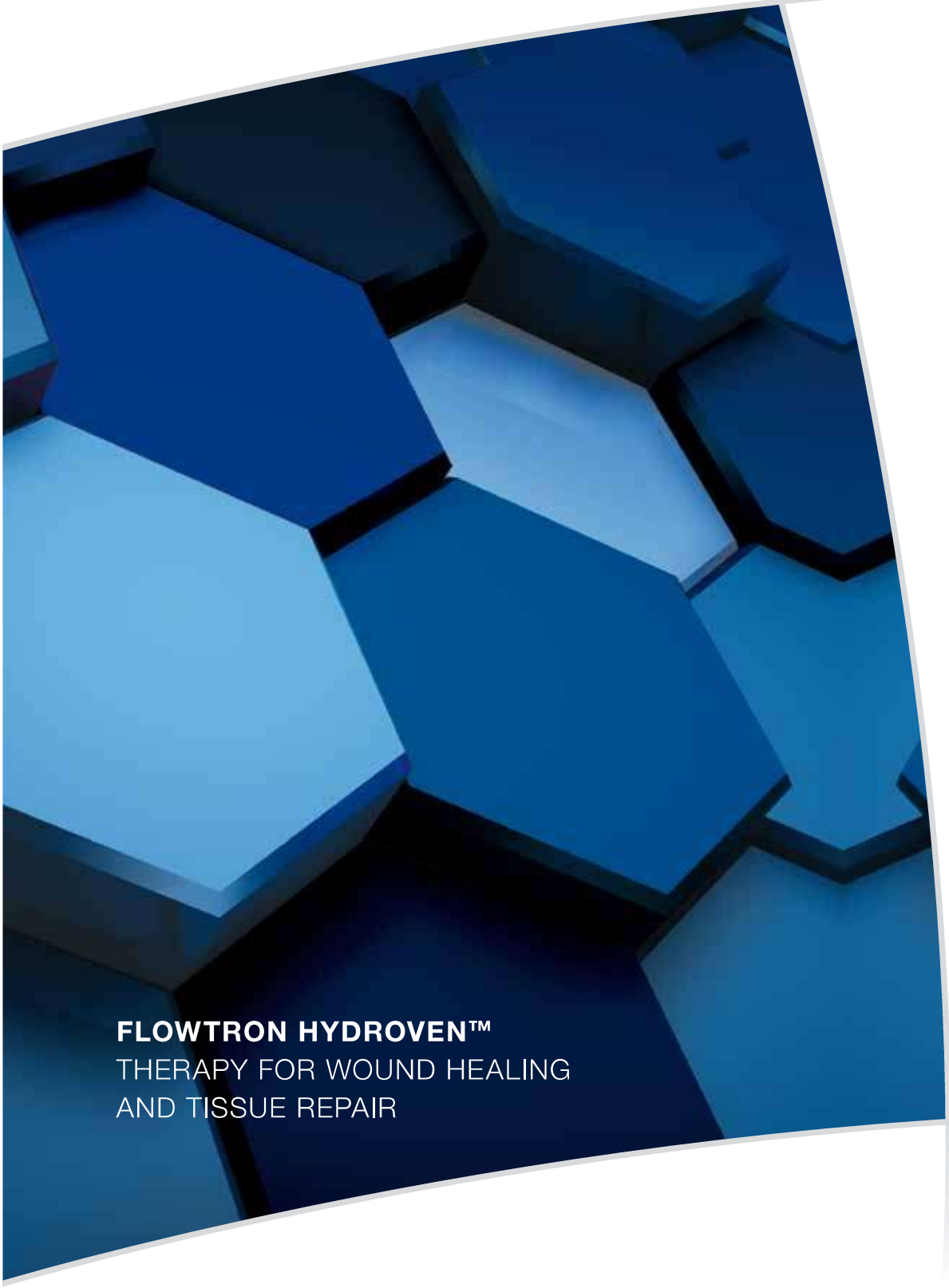
CLINICAL EVIDENCE



FLOWTRON HYDROVEN™
THERAPY FOR WOUND HEALING
AND TISSUE REPAIR

…with people in mind

Contents

Introduction

The challenge of repairing bodily injury is complex and is best understood as a cascade of events which, under normal circumstances, results in tissue repair. In clinical practice however, healthcare professionals regularly deal with chronic wounds such as venous and arterial leg ulcers, which do not heal or frequently recur because of an underlying pathologic process. Impaired blood supply and oedema are contributory factors in non-healing wounds.

In the management of leg ulceration, the first priority is the identification and correction (or control) of the causative and contributory factors (Doughty et al 2000). This will often involve the management of oedema, improving the arterial flow and venous return or a combination of all three, depending upon the underlying pathology. Intermittent Pneumatic Compression (IPC) as a modality may be able to assist in this process.

This brochure has been written for the healthcare professional and provides abstracts of key clinical papers relating to the use of IPC systems in aspects of wound healing and tissue repair, with particular emphasis on leg ulceration.

Mechanical and biochemical effects of IPC

Both haemodynamic and haematological changes occur in the lower extremity, as a result of the sudden application of external uniform pressure (Chen et al 2001).

IPC results in significant increases in both venous (Morris and Woodcock 2004) and arterial (Delis et al 2000) flow. Additionally, there is an increase of pressure in the extracellular space, actively forcing excess fluid (oedema) back into the circulation.

Mechanical

When the lower extremities are compressed, blood is squeezed from the underlying deep veins and is accelerated in a proximal direction.

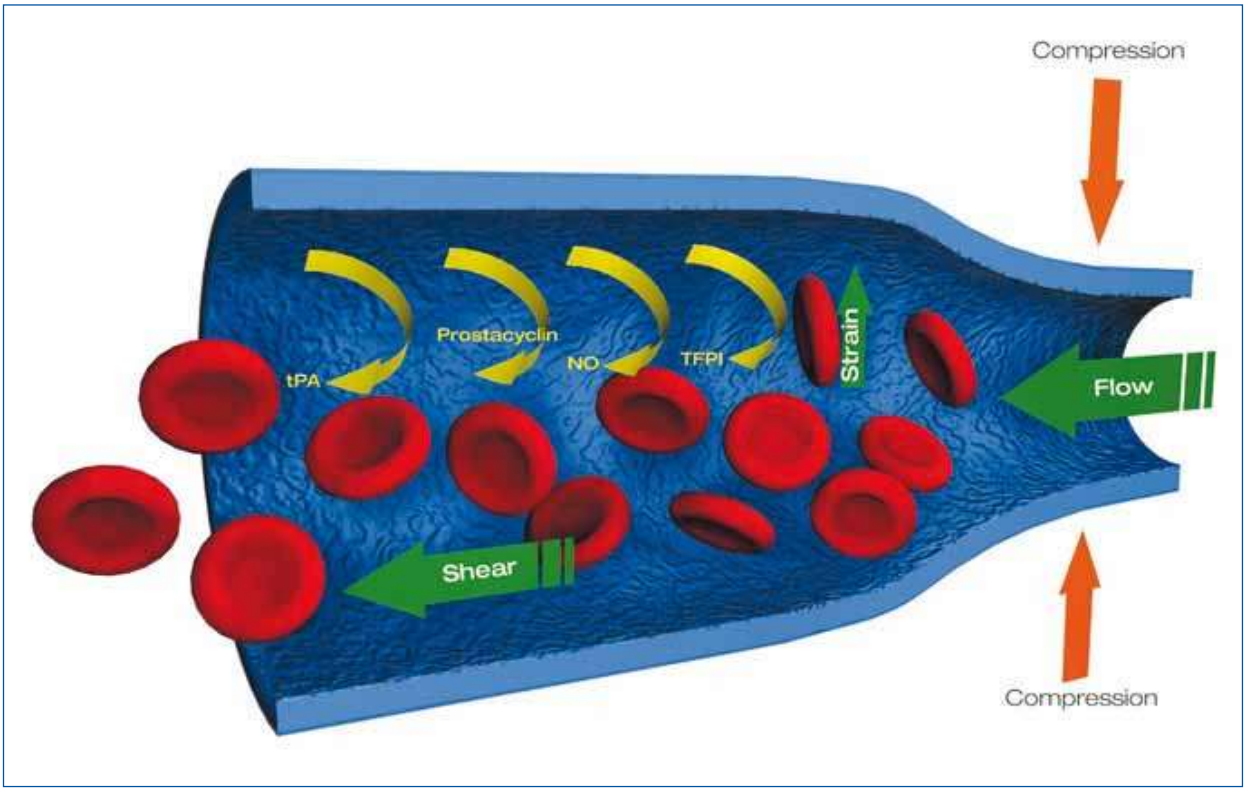
This rapid movement of venous blood results in a sudden lowering of the venous pressure. Consequently, there is an increase in the difference between the arterial and venous pressures – the so called AV gradient – which in turn brings about a resultant increase in arterial flow.

Biochemical

The increased blood velocity in both arterial and venous systems causes distension of the vessels, resulting in increases in both compressive and shearing forces on the endothelial lining. These mechanical forces have been demonstrated to cause physiological responses in the endothelial cells that contribute to the anti-thrombotic, pro-fibrinolytic and vasodilatory effects of IPC (Chen et al 2001).

Pro-fibrinolytic

Haematological studies have demonstrated that patients with chronic venous insufficiency have a reduced plasma fibrinolytic activity (Burnand et al 1982). IPC increases tissue plasminogen activator (tPA) and urokinase-plasminogen activator (uPA) with a corresponding decrease in plasminogen activator inhibitor-1 (PAI-1). These actions have the overall effect of suppressing pro-coagulant activity, whilst enhancing the fibrinolytic mechanism (Comerota et al 1997, Giddings et al 2001).



Mechanical and biochemical effects of IPC on a vein. Diagram adapted from Chen at al (2001).

Use of IPC in venous leg ulcers

Venous leg ulcers (VLU) account for approximately 70–90% of all leg ulcers (Lopez and Phillips 1998). The healing of VLU is a major challenge which absorbs high levels of healthcare resource and more importantly causes significant distress to the individual concerned. The most common aetiologic factor of VLU is venous insufficiency, which is precipitated by venous hypertension. Treatment of venous ulcers requires management of the underlying venous hypertension and failure to address this contributes to high recurrence rates (Doughty et al 2000).

Sustained compression using bandaging has until now, been the recommended first line therapy for venous ulcers (Stacey et al 2002). However, there are many individuals who cannot tolerate or are unable to comply with this therapy (Moffatt and Franks 1995, Berliner et al 2003) and those in whom wounds simply fail to respond.

IPC is effective when used alone or as an adjunct to compression bandaging and has been shown to improve ulcer healing rates (Kumar et al 2002, Stacey et al 2002). The application of IPC is becoming increasingly recognised in this area, not only for recalcitrant ulcers but also as a first line treatment capable of expediting healing.

Chronic venous leg ulcer

Specific advantages of IPC include:

- The efficient removal of oedema by improvement of venous and lymphatic drainage (Schuler et al 1996).
- The increase of superficial capillary perfusion enabling improved skin nutrition (Malanin et al 1999).
- The enhancement of fibrinolytic activity (Comerota et al 1997, Giddings et al 2001) which may assist in the removal of fibrin deposits and prevention of lipodermatosclerosis (Hopkins 2002).

Dynamic *Flowtron Hydroven* Therapy Systems from ArjoHuntleigh are an established method of treating venous leg ulcers, either used alone or as part of a combined approach to therapy.

On the pages that follow are abstracts of clinical work that have been undertaken, highlighting the role of IPC in venous disease.

> *“Our experience has been that intermittent compression therapy immediately stops the cycle of recurrent infection, enabling the wound to recover and commence healing”*
>
> Hopkins 2002

Literature reviews

Managing venous leg ulcers (Cornwall 1991)

Objectives:

A review outlining the diagnosis, assessment and management of venous leg ulcers.

Outcomes:

- An holistic patient assessment must be made of the patient as well as the limb.
- The importance of undertaking an ankle brachial pressure index is highlighted.
- Oedema should be reduced and use of compression pumps such as the Flowtron® Therapy System, is a highly effective method of achieving this.
- A regimen for a minimum of 2 hours, twice a day, at a pressure of 50mmHg is recommended with treatment continuing for at least 6 weeks.
- Graduated hosiery should be worn to prevent re-establishment of oedema.
- Long term management is required to prevent recurrence.

Compression therapy (Choucair and Phillips 1998)

Objectives:

A review of the pathophysiology of venous ulcers and the different types of compression devices available.

Outcomes:

- IPC for home use is prescribed by these authors for patients who have not responded to other compression modalities, particularly those with non-healing venous ulcers and recalcitrant lymphoedema.

Chronic venous insufficiency and venous ulceration (Alguire and Mathes 1997)

Objectives:

A summary of the literature looking at normal venous circulation, epidemiology, pathophysiology and treatment of chronic venous insufficiency.

Outcomes:

- Some patients do not have the strength or mobility to pull on compression stockings.
- IPC is an alternative to the use of compression bandaging or stockings.
- IPC is particularly effective for recalcitrant cases.

The use of intermittent pneumatic compression in venous ulceration (Vowden 2001)

Objectives:

A review examining the role of dynamic compression and possible mechanisms of action. The rationale for use in the immobile person with chronic ulceration is also considered.

Outcomes:

- Studies are presented supporting successful usage of IPC in patients with venous leg ulcers.
- IPC is shown to enhance ulcer healing.
- IPC is a highly acceptable adjunct or alternative therapy for patients.
- Treatment periods of 2 hours would appear to be effective and acceptable to the patient.
- Further research is necessary to clarify and quantify the use of IPC in the treatment of venous ulceration.

The use of intermittent pneumatic compression in venous leg ulcer management (Hopkins 2002)

Objectives:

A review outlining the application of IPC in venous ulceration and the experiences of the East London Wound Healing Centre.

Method:

Patients presenting with the following conditions were selected to receive IPC; the ulcer has a venous component and one or more of the following factors present: non-healing, excessive oedema, persistent infection, mixed arterial/venous pathology.

Outcomes:

- Use of IPC immediately stops the cycle of recurrent infection.
- For mixed aetiology disease, the use of IPC combined with reduced compression bandaging is effective.
- IPC is effective for patients with lymphovenous disease and an extended long term contribution to therapy.
- IPC appears to prevent acute episodes of lipodermatosclerosis.
- IPC improves tolerance of compression bandage therapy by reducing acute oedema.

The effects of intermittent pneumatic compression on the arterial and venous system of the lower limb: a review (Kumar and Walker 2002)

Objectives:

A review to summarise the role of IPC in the prevention of DVT, healing of venous ulcers and its role in the management of arterial disease.

Outcomes:

- Although evidence is limited, IPC demonstrates a clinical benefit in the studies reviewed.
- Compression can be used as an adjunct therapy to bandaging or used alone.
- Patient compliance is good and IPC can be used in the home setting.

A systematic review of pneumatic compression for treatment of chronic venous insufficiency and venous ulcers (Berliner et al 2003)

Objectives:

A systematic review of the evidence for the use of pneumatic compression devices in the home treatment of chronic venous insufficiency and venous ulcers.

Outcomes:

- Often patients do not comply with compression therapies such as stockings and bandages.
- Long term use of pneumatic compression devices in the home environment may be an alternative to other compression therapies.
- Pneumatic compression may be effective for patients who have previously failed treatment with other compression devices.
- Patients who used the devices generally expressed satisfaction and reported higher compliance than with other compression methods.

Clinical studies

Intermittent compression for venous leg ulcers (Hofman 1995)

Design: Case studies.

Objective: A report on the successful use of the *Flowtron* System in two patients with longstanding venous leg ulceration.

Setting: Out-patient clinic/community.

Method: Detailed case histories are presented of 2 patients.

Results: Both patients demonstrated significant improvements in the healing of longstanding venous ulcers. Swelling was also reduced.

Conclusion: *Flowtron* therapy can be considered for those patients with moderate to severe leg oedema and those not compliant with other compression interventions. *Flowtron* therapy can be used in conjunction with compression bandaging. It is recommended that this treatment should be used for a minimum of 1 hour, twice a day, at a pressure of 50mmHg, although lower pressures may also be used if required.

When compression therapy is not enough (Hopkins and Worboys 1999)

Design: Open evaluation.

Objective: To evaluate usage of *Flowtron* therapy in subjects with complex and non-healing venous ulcers.

Method: An open evaluation of 19 clients (23 limbs) evaluating healing rates and other outcomes.

Results: Full healing occurred in 7 limbs and on-going healing was reported in a further 6. Where persistent infection was present, there were no subsequent episodes. Use of the *Flowtron* System did not cause pain and oedema was reduced where present.

Conclusion: *Flowtron* therapy was shown to be successful in a number of subjects in whom standard treatment had failed. *Flowtron* therapy is easy to use in the community setting and facilitates active client partnership.

Intermittent pump versus compression bandages in the treatment of venous leg ulcers (Rowland 2000)

Design: Randomised cross over study.

Objective: To compare healing rates and leg swelling in patients using IPC vs. compression bandaging. Patient compliance and satisfaction were also measured.

Setting: Out-patient clinic/community.

Method: 16 patients were allocated to receive either IPC (*Flowtron* System) or compression bandaging. All ulcers were measured and leg volumes recorded on entry to the study and thereafter every month. After 2-3 months, patients were crossed over to receive the alternative therapy. Following initial assessment, each patient completed a questionnaire to determine compliance and satisfaction.

Results: No significant differences were found between the 2 different treatment regimens. Patients found the pump easier to use and more comfortable compared to bandaging.

Conclusion: The *Flowtron* System is an effective alternative to compression bandaging, particularly where compliance is a problem.

Intermittent pneumatic compression as an adjuvant therapy in venous ulcer disease (Kumar et al 2002)

Design: A 2 phased randomised controlled study, prospectively investigating use of the *Flowtron* System in the healing of new ulcers and also the prevention of ulcer recurrence.

Method:

Study A: (new venous ulcers): 47 patients were randomised to receive either 4 layer bandaging alone or 4 layer + *Flowtron* therapy for one hour twice daily. Treatment was for 4 months or until healing.

Study B: (recently healed venous ulcers): 53 patients were randomised to receive compression hosiery alone or hosiery + *Flowtron* therapy. Treatment was for 4 months or until recurrence.

Results:

Study A: There was a high rate of healing in both groups (87% in the *Flowtron* group vs. 92% in the control group). However, the rate of healing was significantly faster in the *Flowtron* group (53 days for *Flowtron* and bandaging vs. 74 days for bandaging alone).

Study B: There was no statistical difference between recurrence rates.

Conclusion: *Flowtron* therapy has a positive effect on venous ulcer healing. *Flowtron* Systems are well tolerated and compliance levels are high.

Managing difficult limbs with intermittent compression (Poore et al 2003)

Design: Retrospective case note review.

Objective: To evaluate the effects of *Flowtron* therapy on a cohort of patients with venous ulcers, in whom optimal standard therapy had failed.

Method: A case note review of 12 subjects (11 with non–healing ulcers and one with uncontrolled oedema) was undertaken which included; monthly photographic records, wound tracing, leg measurements, dressing regimens, ABPI and pain assessment.

Results: Ulcers healed in 5 patients and a further 5 demonstrated improvement. The patient with previously uncontrolled oedema improved so much that she was able to return to wearing hosiery. With the exception of 1 patient, *Flowtron* therapy was reported to be soothing and relaxing.

Conclusion: *Flowtron* therapy contributed greatly to the healing and improvement of ulceration and oedema experienced by this cohort of patients.

Leg ulcer

Use of IPC in the management of oedema and acute wounds

Oedema is the pathological accumulation of fluid in the interstitial space. The presence of oedema in the lower limb delays healing by increasing the diffusion distance between the blood capillaries and the tissues they serve. Tissues become starved of oxygen and metabolic waste builds up (Morison and Moffatt 1994). The physical swelling can cause significant disability. Peripheral oedema can result from a variety of acute and chronic conditions including venous hypertension, immobility, heart failure, surgery and trauma. Removing oedema is an important step in initiating wound healing in both acute and chronic wounds; it can also help prevent initiation and recurrence of wounds. IPC is a highly efficient and cost effective treatment for peripheral oedema and works by elevating tissue pressure and driving oedema from the tissues to the blood.

Oedematous foot

In addition, IPC improves haemodynamics in the lower limbs, enhancing venous, arterial and microvascular blood flow.

Literature reviews

Adjuvant medical therapy to deep venous reconstruction (Boudouroglou et al 2004)

Objectives:

A discussion of the use of adjuvant medical therapies including application of IPC for patients following surgical venous reconstruction.

Outcomes:

- DVT is a common complication following surgical deep venous reconstruction. Use of IPC post-operatively significantly reduces this risk.
- Use of IPC reduces leg oedema and promotes wound healing in this patient group.
- A combination of therapies including anticoagulation, graduated compression stockings and IPC should be considered as adjuvant medical management.

A review of the role of sequential compression therapy in post-operative management of patients undergoing venous valve surgery (O'Neill 1997)

Objectives:

A literature review of the theoretical basis for use of IPC in the post-operative management of patients following venous valve surgery.

Outcomes:

- IPC is recommended for patients following venous valve surgery to prevent DVT, decrease the requirement for high dosage of heparin, promote blood flow through the repaired/transplanted valve, promote healing and decrease oedema.
- Application of IPC is required immediately post-operatively to prevent DVT.
- Incidence of haematoma is variable and ranges from 3-30% and thought to be due to heparin. Use of IPC is not associated with this risk.
- IPC therapy should be a routine component of the post-operative management for patients undergoing venous valve surgery.

Clinical studies

Intermittent pneumatic compression pump settings for the optimum reduction of oedema (Grieveson 2003)

Design: Randomised controlled trial.

Objective: To determine the most effective pressure settings for optimum removal of oedema.

Method: 27 subjects with a history of ankle oedema of venous origin of at least one year were randomised into 2 groups. This consisted of either; the treatment group, using a Flowpac® pump and single compartment (toe to knee) garment, or the control group, who sat with both legs elevated for 45 minutes. Limb volumes were measured and compared.

Different pressures were utilised with the *Flowpac* pump to identify the optimum pressure setting.

Results: The highest mean reduction in limb volumes as compared to the control group was recorded for use of the *Flowpac* pump with a pressure of 40mmHg.

Conclusion: All significant results were found at low pressures. The optimum setting appeared to be at 30-40mmHg.

The use of intermittent pneumatic compression to reduce oedema in lower limb fractures (Bañuls-Pattarelli 1998)

Design: Randomised controlled trial.

Objectives: The effectiveness of IPC (Flowtron Plus™ System) in reducing the swelling of ankle fractures and reducing the delay to surgery.

Method: Patients with closed and unstable ankle fractures in need of surgery were randomised into 2 groups. 34 patients were allocated to either IPC or a regime of elevation and cryotherapy. Data collected included time to surgery, pain and analgesia, oedema, and length of stay.

Results: Pre-operative time was reduced to an average of 30 hours compared to over 160 hours for the control group and the average length of hospital stay was reduced by 31% (9 vs. 13 days).

Pain and analgesic requirements were substantially reduced and no major complications were recorded.

Conclusion: IPC is perceived to be an effective and simple method to reduce pre-operative swelling in ankle fractures.

A prospective randomised trial using intermittent pneumatic compression to the donor leg after long saphenous vein harvest (John et al 2004)

Design: Randomised controlled trial.

Objectives: To test the effectiveness of Flowtron therapy in oedema reduction, pain reduction and wound healing after vein harvesting for coronary artery bypass grafting.

Method: 42 patients were randomised to receive Flowtron therapy for 2 hours, in the immediate post-operative period and for 4 hours thereafter until discharge. Patients were assessed for wound healing, leg circumference, pain at harvest site and satisfaction of using the device.

Results: Compared with the control group there was less pain, less oedema, a higher rate of wound healing and greater satisfaction.

Conclusion: The use of an IPC device to the donor leg after vein harvest, improves wound healing and enhances patient comfort.

> *“The available evidence suggests that the potential benefits of IPC therapy include its non-invasive nature, its ability to be applied by patients or their carers, its safety and comfort and its long term cost saving both in material and nursing time”*
>
> Vowden 2001

Use of IPC in other aspects of healing and tissue repair

The modality of IPC using various garments, pressure profiles and time cycles has been demonstrated to be beneficial in a number of other applications including:

- Reduction of oedema following fractures and trauma to the foot and ankle (Erdmann et al 1992, Myerson and Henderson 1993, Thordarson et al 1997, Thordarson et al 1999, Juliano et al 2000, Park and Silver 2003 and Bañuls-Pattarelli 1998).
- The treatment of fixed flexion deformities in rheumatoid arthritis (Majkowski and Atkins 1992)
- Healing of previously un-healed ischaemic ulcers (Montori et al 2002).
- A potentially beneficial effect on bone mineral density and muscle : fat ratio in sedentary post-menopausal women with osteoporosis (Albertazzi et al 2004).
- Healing of long term diabetic ulcers (Wunderlich et al 1998, Montori et al 2002).
- Improvement of arterial blood flow in patients with peripheral ischaemic disease (Gaskell and Parrott 1978, Delis et al 2000, Van Bemmelen et al 2001).

In terms of acute wound therapy, the studies cited have demonstrated highly positive outcomes with respect to the use of IPC.

Flowtron Hydroven 3 Therapy System

Flowtron Hydroven 12 Therapy System

In a bid to provide quality systems tailored to meet clinicians and patients needs, The *Flowtron Plus*, *Flowpac* and Flowpress® Systems have been replaced by the *Flowtron Hydroven 12* and *Flowtron Hydroven 3* Therapy Systems.

Summary

The mechanisms of action of IPC are only beginning to be fully investigated and further research is required to fully understand these processes. There has been an increase in the number of people with circulatory disease resulting in chronic ulceration of the lower limb; this figure is set to increase as our population ages.

Evidence to date highlights the known benefits of IPC; it is safe, non-invasive, comfortable, can be applied by users or their care givers and often offers significant cost savings (Vowden 2001).

Dynamic *Flowtron Hydroven* therapy is a cost effective modality which has the potential to prevent or attenuate these disease processes.

Please contact ArjoHuntleigh if you require further information

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RECOMMENDED PROTOCOL FOR USE

FLOWTRON HYDROVEN™ THERAPY

ACTIVE COMPRESSION THERAPY FOR
THE MANAGEMENT OF LYMPHOEDEMA

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Introduction

Lymphoedema results from a damaged or blocked lymphatic system which results in proteins and excess fluid remaining in the interstitial spaces[1]. The goal of therapy is to reduce the amount of swelling experienced by the individual in order to retain or restore function and cosmesis to the affected limb[2]. A review of the literature suggests that a variety of techniques used within a multidisciplinary framework over a protracted timescale should be used to manage lymphoedema[2]. Current management protocols include elevation, elastic compression garments, massage as part of decongestive therapy and the use of intermittent pneumatic compression (IPC)[3].

Flowtron Hydroven™ Systems for Active Therapy

ArjoHuntleigh offers a comprehensive range of IPC systems for the treatment of venous and lymphatic conditions. Each of the products in the *Flowtron Hydroven* range is safe, non-invasive and simple to use and provides clinicians with a natural solution to the management of these conditions.

Flowtron Hydroven 12 System

The *Flowtron Hydroven 12* System sets a new standard in the treatment of venous and lymphatic disorders. This ultimate high performance unit for use with Hydroven™ 12 chamber garments provides the clinician with a choice of dynamic inflation sequences (gradient sequential, wave and LymphAssist™), therapy cycles and treatment parameters providing optimal therapy conditions for individual patient care.
The unique *LymphAssist* inflation and deflation sequence, designed according to the principles of manual lymphatic drainage (MLD), aims to help clear the proximal lymphatics and promote efficient fluid transfer through the lymphatic system.

Flowtron Hydroven 3 System

The *Flowtron Hydroven 3* System offers the flexibility to be used with single (*Hydroven 1*) or three (*Hydroven 3*) chamber garments. This simple to use, lightweight pump with preset cycle times and adjustable pressure settings for individual comfort makes the *Flowtron Hydroven 3* System ideal for providing safe and effective gradient sequential compression therapy in the home as well as the clinic.

Purpose

The application of Flowtron® therapy assists in the control, reduction and treatment of lymphoedema and should be considered as part of an holistic approach to management of this condition.

Indications

- IPC is particularly effective when used in non-obstructive oedemas such as immobility, venous incompetence, lymphovenous stasis and hypoproteinaemia[4]
- In obstructive lymphoedema, the patient or therapist should perform simple lymphatic drainage (SLD) or Manual Lymphatic Drainage (MLD) prior to use to stimulate lymphatic flow from the adjacent truncal areas[4]. *LymphAssist* may support the clinician with this procedure

Contraindications

Flowtron Hydroven Systems should not be used in the following conditions:

- Known or suspected deep vein thrombosis (DVT), pulmonary embolism, thrombophlebitis and acute untreated infections of the skin such as cellulitis
- Decompensated/severe congestive cardiac failure, pulmonary oedema associated with significant limb oedema or any condition where an increase of fluid to the heart may be detrimental
- Severe arteriosclerosis or other ischaemic vascular disease
- Active metastatic disease affecting the limb

Cautions

IPC should be used with care in patients with the following symptoms or conditions:

- Peripheral neuropathy, pain or numbness in the limb
- Undiagnosed, untreated or infected wounds, fragile skin, grafts or dermatological conditions that may be aggravated by the garment
- Extreme limb deformity which may practically impede the correct application of the garment

Guidelines for Use

These are guidelines only and should not replace clinical judgement or experience.

- Pressures of between 30-60 mmHg are typically advised as these have been found to be most effective in clinical studies [4-6]. Lower pressures are advised in palliative care [4]
- Frequency is recommended between 30 minutes and 2 hours daily [4-6]

Hydroven garments must be removed prior to mobilisation.

British Lymphology Society

The British Lymphology Society [BLS] provides the following guidelines for the use of IPC in lymphoedema [4]:

Before IPC

- Explain the procedure to the patient
- All jewellery should be removed from the body part to be treated
- Advise patient to empty bladder
- Ensure the patient is lying in a comfortable position with the affected limb elevated

Administering IPC

- Apply a cylindrical cotton bandage (such as a stockinette) to the limb if necessary
- Apply the IPC garment to the limb ensuring any valves on the garment are closed
- First session:

  – familiarise the patient with the treatment

  – set the pressure to 30 mmHg for 30 minutes (possibly only 20 mmHg in palliative care)
- Subsequent sessions:

  – set the pressure to 40 mmHg for 30-60 minutes (possibly 20-30 mmHg in palliative care)
- Switch on the machine
- When treatment is complete, switch off the machine and remove garment

After IPC

- Repeat SLD or MLD
- Fit compression garment or apply multi-layer lymphoedema bandages
- Limb volumes should be measured regularly e.g. weekly

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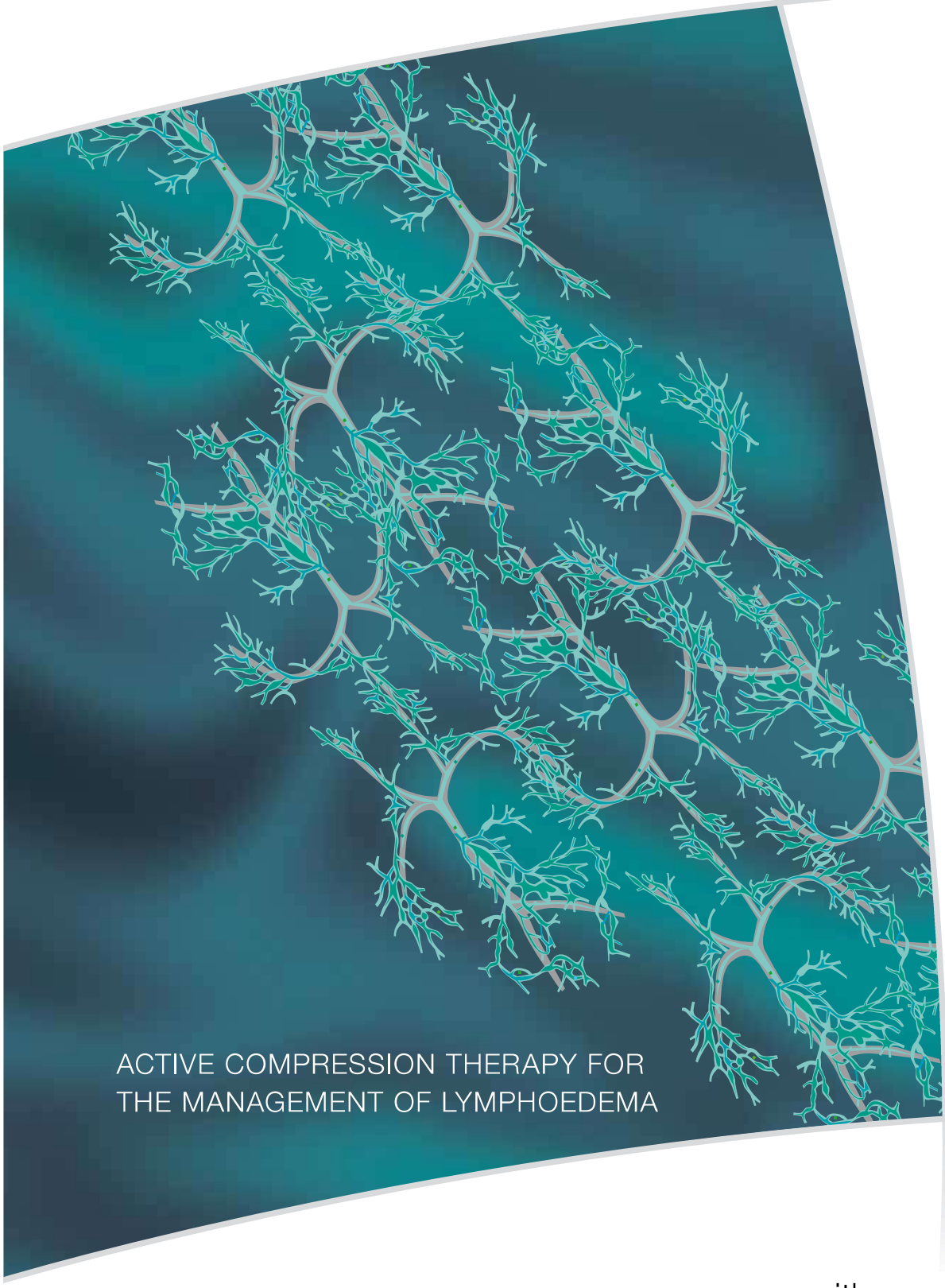


ACTIVE COMPRESSION THERAPY FOR THE MANAGEMENT OF LYMPHOEDEMA

…with people in mind

Contents

Introduction

Lymphoedema is a chronic swelling usually affecting a limb, which occurs from accumulation of fluid and other tissue elements that would normally drain via the lymphatic system (Morgan et al 2005a). The degree of swelling can range from mild to severe and can be accompanied by loss of sensation in the affected limb and skin changes including pitting, abrasions and cellulitis. Untreated, the limb can become disfigured, heavy and large with loss of skin elasticity (Passik and McDonald 1998).

Chronic lymphoedema is a common but under reported condition (Moffatt et al 2003) for which there is no cure. In countries with advanced health care systems, breast cancer treatment is a major cause of lymphoedema (Bianchi and Todd 2000). Approximately 28% of women undergoing surgery for breast cancer will develop lymphoedema, with this figure increasing in those who undergo additional radiotherapy (Mortimer et al 1996).

Lymphoedema also affects a significant number of other types of patients where the cause is not oncology related. A recent epidemiological study in London (Moffatt et al 2003) highlighted the prevalence of lymphoedema as being similar to that of leg ulceration with the rate significantly increasing to 1 in 200 people over the age of 65.

People who suffer with lymphoedema experience a range of physical, psychological and social problems (Bianchi and Todd 2000, Moffatt et al 2003). Traditionally lymphoedema has been seen as an unfortunate, relatively unimportant and untreatable side effect of life saving cancer treatment (Sitzia and Harlow 2002). However, there is increasing awareness that lymphoedema is a complex problem, significantly affecting quality of life in a wide range of people (Moffatt et al 2003, Morgan et al 2005b).

Despite this recognition, there remain major deficits in specialist care provision, particularly for those whose condition is non-cancer related (Moffatt et al 2003, Tiwari et al 2006). Within the UK, a major project is currently underway to develop, implement and evaluate a model of care for patients with lymphoedema being cared for in a community setting (Morgan et al 2005a).

The goal of therapy is to ease the amount of swelling experienced in order to retain or restore both function and cosmesis to the affected limb, together with improving or maintaining patient quality of life (Morgan et al 2005b, Brennan and Miller 1998). A review of the literature suggests that a variety of techniques used within a multidisciplinary framework should be employed to manage lymphoedema (Brennan and Miller 1998). Current management protocols include elevation, elastic compression garments, massage as part of decongestive therapy and the use of Intermittent Pneumatic Compression [IPC] (Petrek et al 2000).

This booklet has been written for the healthcare professional. It provides abstracts of key clinical papers relating to the use of Active Compression Therapy, also referred to as IPC, as part of holistic care for management of lymphoedema.

The formation of oedema and lymphoedema

Chronic oedema: the critical role of the lymphatic system (Mortimer and Levick 2004)

Oedema can be defined as an excess of interstitial fluid within the tissues. Chronic peripheral oedema is a common problem and a variety of systemic and peripheral health problems may be implicated. Chronic oedema impairs local cell nutrition due to increased interstitial diffusion distances for oxygen and nutrients and as a result tissue viability may become compromised.

Peripheral oedema develops when microvascular (capillary and venule) filtration rate exceeds lymph drainage capacity. This may be because of a high filtration rate or low lymph drainage/ transport capacity or a combination of the two. Build up of capillary filtrate in the tissue spaces is avoided mainly through lymph drainage and not as was previously thought through reabsorption by the capillaries.

Increased interstitial fluid pressure and volume stimulates lymph flow. The transport of interstitial fluid into the lymph vessels is complex, poorly understood and is dependent upon changes in tissue pressure from movement (both active and passive exercise), massage, local arterial flow and breathing in more central tissues. Lymphoedema results when lymphatic drainage is impaired whilst normal capillary filtration occurs.

The lymph system is intimately linked with venous drainage. Research has shown that in patients with leg ulceration there is often a combination of both venous disease and lymphoedema, with each condition aggravating the other (Kim et al 1999, Mortimer 2000, Szuba et al 2002).

Lymphoedema differs from oedema in that over time, there is secondary proliferation of fibro-fatty tissue, the accumulation of collagen and the destruction of elastin fibres within the skin (Szuba et al 2002). These skin changes create challenges in the treatment and highlight the requirement for a multi-modality approach.

Secondary lymphoedema following breast surgery

Chronic oedema

Primary lymphoedema in a patient post kidney failure

Consensus papers and guidelines for the use of Active Compression Therapy for the management of lymphoedema

The Lymphoedema Framework

The Lymphoedema Framework is a UK based research partnership launched in 2002 that aims to raise the profile of lymphoedema and improve standards of care through the involvement of specialist practitioners, clinicians, patient groups, healthcare organisations, and the wound care and compression garment industry (Lymphoedema Framework 2006). The Lymphoedema Framework has been endorsed by many established lymphoedema organisations around the world, and recognised by the World Health Organisation. IPC is acknowledged within the Lymphoedema Framework document as being one of the treatment modalities available to help manage the symptoms of lymphoedema. The Lymphoedema Framework document recognises that:

- IPC can form part of an intensive therapy regimen or long-term management in selected patients, and may be used with caution in the palliative situation.
- Multi chambered IPC devices are used most frequently and randomised controlled trials have shown them to produce a faster effect than single chambered devices.
- IPC is particularly effective in non-obstructive oedema, e.g. those due to immobility, venous incompetence, lymphovenous stasis or hypoproteinaemia.
- In obstructive lymphoedema, i.e. lymphoedema resulting from lymphatic vessel / node damage or lymph node resection, it is recommended that Simple Lymphatic Drainage (SLD) or Manual Lymphatic Drainage (MLD) should be performed before IPC to stimulate lymphatic flow.
- It is important that compression therapy with garments or bandaging is continued after IPC to prevent rapid rebound oedema.
- Careful surveillance is required to ensure that the correct technique and pressures are applied. Pressures should be adjusted according to patient tolerance and their response to treatment. In general:

– pressures of 30-60mmHg are advised

– lower pressures are advised in palliative care, e.g. 20-30mmHg

– a duration and frequency of 30 minutes to two hours daily is recommended

(Lymphoedema Framework 2006)

British Lymphology Society

The British Lymphology Society (BLS) aims to promote awareness about lymphoedema to the public and health care professionals. The BLS is actively involved in promoting the need for equitable and sustainable services for people living with lymphoedema, and encourages research in the management of lymphoedema, and other areas related to this condition. Members of the BLS include healthcare professionals, as well as others who are directly involved in the management of lymphoedema (www.lymphoedema.org/bls).

In the BLS Framework for Education 2001 document, IPC is listed as an effective technique used in the management of chronic oedema. The BLS Chronic Oedema Population and Needs 2001 document, which should be used in conjunction with the BLS Framework for Education 2001 document, recommends IPC in the treatment plan options for people with moderate to severe or complicated oedema. IPC is also listed as a treatment method, to be used with caution, for people with oedema and advanced malignancy (British Lymphology Society 2001).

International Society of Lymphology

The International Society of Lymphology (ISL) was founded during the First International Symposium of Lymphology in Zurich, July, 1966 and now has some 375 members from 42 nations (www.u.arizona.edu/~witte/ISL.htm).

The consensus document published by the ISL entitled *The Diagnosis and Treatment of Peripheral Lymphoedema* attempts to amalgamate the broad spectrum of protocols advocated worldwide for the diagnosis and treatment of peripheral lymphoedema into a coordinated proclamation representing a consensus of the international community (International Society of Lymphology 2003).

Under section 4 of the document, entitled *Treatment*, a two-phase IPC programme is recommended. It states that after compression therapy is applied, preferably by a sequential gradient "pump," form-fitting, low-stretch elastic stockings or sleeves are used to maintain oedema reduction (International Society of Lymphology 2003).

The ISL recommends that where IPC is used, it is done so under careful observation to ensure that patients receive the correct treatment pressures and duration to obtain a positive outcome.

Mechanical and biochemical effects of Active Compression Therapy

Unlike the vascular system that relies on the heart to pump blood, the lymph vessels rely on intrinsic factors to propel lymph from the tissues back to the vascular circulation.

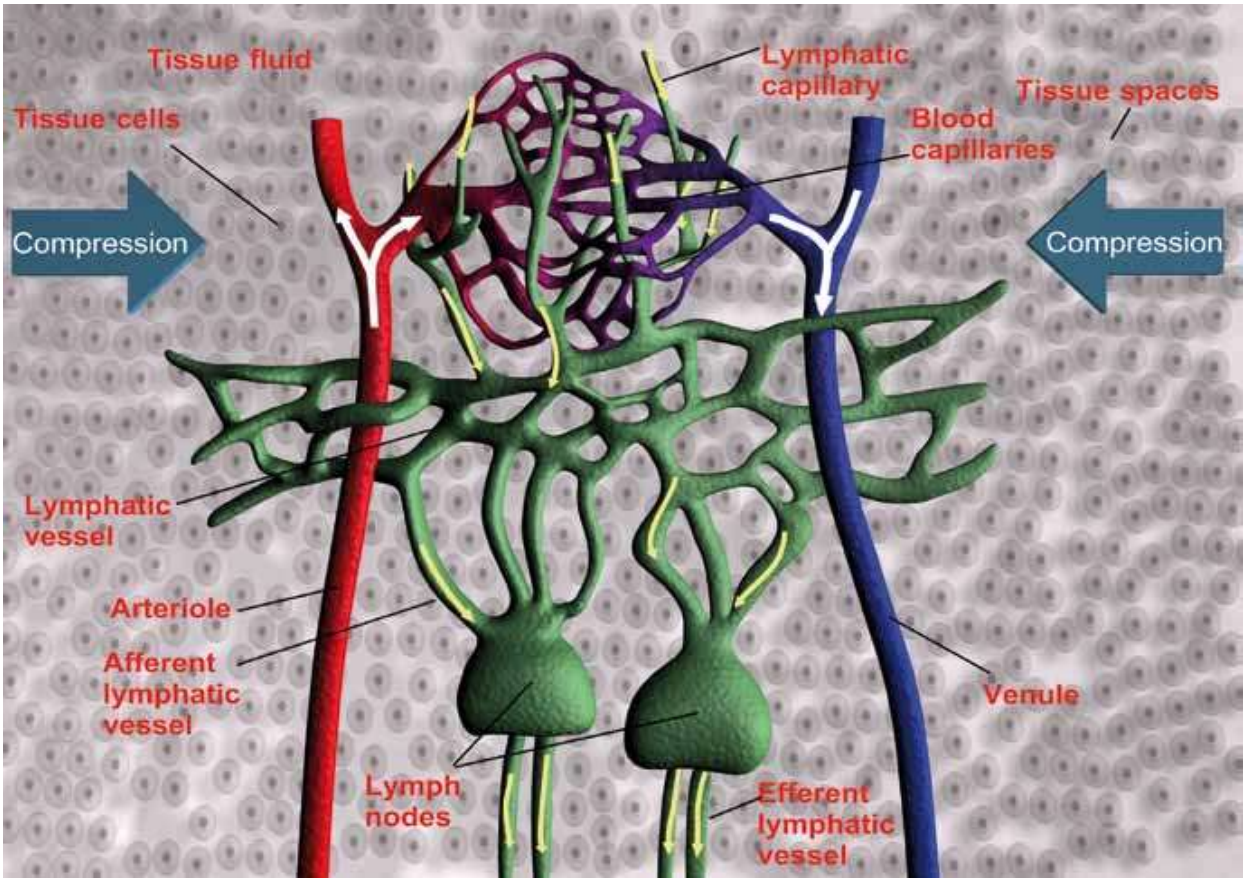
The small lymph vessels are reliant upon pressure changes within the lymph itself, pulsation of neighbouring arteries and skeletal muscle contraction. The larger lymphatic collecting vessels are contractile and possess valves rather like veins, preventing backflow of lymph.

External pressure from IPC increases the interstitial pressure in the extracellular space causing excessive fluid (oedema) to become actively forced back into the circulation (Chen 2001).

IPC softens and reduces limb volume and enhances the therapeutic response both in the initial decongestive phase of lymphoedema therapy as well as in the maintenance of volume reduction (Szuba et al 2002).

There is also evidence to suggest that IPC opposes production of interstitial fluid/lymph by reducing the blood capillary filtration rate, thereby addressing the balance in lymph kinetics responsible for oedema in the first place (Miranda et al 2001). In those with oedematous limbs, this action decreases the cross sectional area and reduces the tensile stretch on the skin (Chen et al 2001), which in turn reduces the diffusion distance for oxygen and nutrients.

IPC mimics the action of the calf muscle pump and this can be likened to what happens when a person walks and utilises the calf muscles. The action of IPC significantly increases both venous (Morris and Woodcock 2004) and arterial (Delis et al 2000) blood flow. Activation of the calf muscle pump is also thought to be a potent stimulus to lymphatic flow and promotes a sudden increase in lymphatic filling that consequently also results in an increase in contractility of the larger lymphatic



Schematic diagram of the microcirculation and associated lymphatic system

vessels (Mortimer 2000). The calf muscle pump is often absent or diminished in those who are immobile or have circulatory disorders (Poore et al 2002) and activation of this pump (by walking, weight bearing or using IPC) is important in the management of both venous and lymphatic disorders.

The rapid movement of blood results in a sudden lowering of the venous pressure. Consequently, there is an increase in the difference between the arterial and venous pressures across the capillary beds, known as the AV gradient, which enhances capillary perfusion (Malanin 1999) and increases arterial flow velocity.

In addition to the direct mechanical actions, IPC enhances fibrinolytic and suppresses pro-coagulant activity (Comerota et al 1997, Giddings et al 2001) that may assist in the removal of fibrin deposits and prevent acute episodes of lipodermatosclerosis (Hopkins 2002). It is these actions which may be responsible for the softening of longstanding fibro-fatty lymphoedematous tissue reported in several case studies (Hopkins 2002, Benton Jones 2005).

LymphAssist™ Therapy

The Flowtron Hydroven™ 12 System offers a choice of different treatment options including gradient sequential therapy, wave therapy and *LymphAssist* therapy. *LymphAssist* therapy is a unique patented inflation and deflation sequence, designed according to the principles of Medical Lymphatic Drainage (MLD), which aims to help clear the proximal lymphatics to assist lymph flow in the affected limb.

By mimicking the sequence of pressures applied in MLD in a proximal to distal direction, progressively down the limb, the unique *LymphAssist* therapy helps promote efficient fluid transfer through the lymphatic system.

Application of *LymphAssist* therapy

The use of Active Compression Therapy as part of the management of lymphoedema – key clinical abstracts

Factorial analysis in radionuclide lymphography: assessment of the effects of sequential pneumatic compression (Baulieu et al 1989)

The effects of IPC in 12 patients with lower or upper limb lymphoedema were studied using a computer based technique of dynamic lymphoscintingraphy.

- A sub-cutaneous injection of radiocolloid was placed into the inter-digital web space of the arm or leg.
- IPC was applied during the last 20 minutes of the recording and the effect was noted immediately.
- A beneficial effect of IPC was detected in 18 out of 22 limbs examined.
- The imaging suggested that IPC facilitated radiocolloid transport in the proximal portion of the limb and also propelled tracer from the injection site towards the lymphatics.

A randomised study comparing manual lymph drainage with sequential pneumatic compression for treatment of postoperative arm lymphoedema (Johansson et al 1998)

MLD was compared with sequential pneumatic compression (SPC) for treatment of unilateral arm lymphoedema in 28 women previously treated for breast cancer.

- All patients had 2 weeks of standard therapy using a compression sleeve to maintain limb volume (part I).
- In part II of the study, patients were randomised to receive either MLD (Vodder technique) or SPC for 2 weeks.
- There was a 7% reduction for all limbs in part I. In part II, the SPC group's limb volume decreased by a further 7%.
- MLD and SPC both significantly decreased arm volume.

The physical treatment of upper limb edema (Leduc et al 1998)

220 patients who had undergone breast surgery, were followed for the first 2 weeks of treatment for upper limb edema.

- Treatment consisted of the application of MLD (Leduc method), the use of multi-layered bandages and the use of IPC. Patients were treated on an outpatient basis.
- The edema was measured by tattooed (semi permanent pen) marks on the skin and comparisons were made between the healthy and the lymphoedematous arm.
- 50% decreases were achieved during the first week of treatment.
- Combination therapy using a variety of physical methods is the best approach for management of patients with lymphoedema.

> *"This physical therapeutic approach allows the patient to be treated, while benefiting from a normal, professional, and family lifestyle"*
>
> Leduc et al (1998)

Overview of treatment options and review of the current role and use of compression garments, intermittent pumps and exercise in the management of lymphedema (Brennan and Miller 1998))

This paper provides a review of treatment options for lymphoedema following breast cancer.

- The role of IPC is discussed as part of an integrated multi-disciplinary treatment approach incorporating garments, exercises and massage.
- Patients have a wide variety of responses and tolerances to these devices.
- Optimal pressure ranges, inflation/ deflation cycles, length and frequency have not been established.
- Pumps used at relatively low pressures are advocated as part of a comprehensive programme.

Effect of sequential intermittent pneumatic compression on both leg lymphoedema volume and on lymph transport as semi quantitatively evaluated by lymphoscintigraphy (Miranda et al 2001)

This study prospectively evaluated the effect of IPC on both lymphoedema volume of the leg and isotope lymphography.

- These tests were performed before application of IPC (control) and after a 3 hour session of IPC involving 11 patients.
- Analysis of the lymphoscintigrams was performed by 3 physicians who were blinded to the study protocol.
- There was a significant reduction in leg volume after IPC but no difference in the lymphoscintigrams.
- The results suggest that IPC works in one of two ways; it either increases transport of lymph fluid (water) from the tissues, or alternatively, IPC may work by decreasing the amount of lymph formation thereby restoring the balance in lymph kinetics responsible for oedema in the first instance.

Decongestive lymphatic therapy for patients with breast carcinoma – associated lymphoedema (Szuba et al 2002))

This study was conducted to assess the suitability of IPC as a component of the therapeutic regimen for patients with newly treated breast carcinoma and a cohort of those with stable, treated breast carcinoma.

- 23 patients who had not been previously treated for lymphoedema were randomised to receive either decongestive lymphoedema therapy (DLT) alone or DLT with adjunctive IPC.
- 27 patients with stable, treated breast carcinoma were randomised as above.
- Objective assessment included serial measurement of limb volume by water displacement, tissue tonometry for assessment of skin elasticity and goniometry to measure joint mobility.
- During initial treatment, the addition of IPC to standard DLT yielded a significant additional limb volume reduction.
- For those patients receiving maintenance therapy, there was a mean increase in volume with DLT alone but when IPC was combined with DLT there was a significant decrease in limb volume.
- IPC was well tolerated and resulted in no complications.
- IPC provides an enhancement of the therapeutic response.

> *"Pneumatic compression pumps can be used safely and effectively for the treatment of patients with breast carcinoma-associated lymphoedema. The case of application of IPC as a long term therapeutic intervention suggests that it may warrant more wide spread use in this patient population"*
>
> Szuba et al (2002)

Differential diagnosis, investigation, and current treatment of lower limb lymphoedema (Tiwari et al 2003)

This review paper considers the differential diagnosis, methods of investigation and available treatments for lower limb lymphoedema in the western world.

- The main aims of treating patients with lymphoedema are to prevent the progression of disease, to achieve mechanical reduction and reduction of limb size, to alleviate the symptoms and to prevent skin infection.
- Pneumatic pumps can be effective. Following treatment, patients should continue to wear compression stockings as there is a high risk of recurrence.
- The treatment of choice for lymphoedema is multidisciplinary. A combination of methods is employed to achieve optimal benefit.

The speedy resolution and ongoing prevention of gross lymphoedema using the Flowtron® compression therapy system (Benton-Jones 2005)

A case study is presented outlining the care of one lady with severe bilateral lymphoedema.

- Previous care had required 3 visits per week by the district nursing service for dressing changes to leaking legs. Patient mobility was compromised, she experienced uncontrollable bilateral leg pain, shoes could not be worn and her quality of life was poor. The local lymphoedema clinic had advised that no treatment was available.
- The local tissue viability service was asked to see this lady. A combination of compression bandaging supplemented by three times daily sessions with *Flowtron* therapy was prescribed. Limb circumference and limb photography (see images below) were undertaken for assessment purposes.
- The evaluation occurred over a 7 month period, with great improvement being noted within 2 months. There was a reduction in overall limb size, district nursing visits were no longer required, skin breakdown and leakage resolved, pain reduced to a level where analgesics were no longer required, standard sizes of compression hosiery and shoes could be worn and a significant improvement in patient quality of life was demonstrated.
- Although the patient's feet remained oedematous, this was now soft and compressible. Use of *Flowtron* therapy enhanced oedema reduction, healing and on-going use is reducing the risk of recurrence.

Before therapy

After 7 months of therapy

The role of intermittent pneumatic compression in the management of lymphoedema (Wigg et al 2006)

PATIENT A

61 year old with primary lymphoedema since 1966.

Objectives: To reduce limb volume & thickening (fibrosis) in the tissues.

Method: A *Flowtron Hydroven 12* pump on *LymphAssist* inflation mode was used as a stand alone treatment. Treatment involved 2 cycles (40 minutes) per session for 10 sessions, over 2 weeks.

Results: Limb volume reduction of 400ml with significant improvement in tissue changes and flexibility. There was a reduction in lymphangiomata (lymphatic blisters) and ongoing reduction in limb volume with double layered hosiery (700ml total reduction).

> *"First thing in the morning, my leg looks better than it has for years"*

PATIENT B

35 year old with primary lymphoedema, which has increased substantially since pregnancy. The patient had a solid leg with an excess volume of 5500mls.

Objectives: To reduce limb volume and 'solid' leg.

Method: Multi layer bandaging (MLLB) and *Flowtron Hydroven 12* pump on the *LymphAssist* inflation mode were applied for 2 weeks. Initial MLD clearance of inguinal nodes was carried out, followed by 2 *LymphAssist* cycles (40 minutes).

Results: A 1600ml limb volume reduction was recorded after 2 weeks (see images below). Improved flexibility and a significant change in tissue texture from a 'solid' leg to a wobbly calf were noted.

Patient B before therapy

Patient B after 2 weeks of therapy

> *"[IPC] improved flexibility and was less invasive than MLD. I will be able to kneel and play on the floor now"*

PATIENT C

50 year old with primary lymphoedema, which has increased due to acute inflammatory episode, sensitivity and allergies.

Objectives: To soften the leg and improve flexibility.

Method: Monthly MLD was substituted for 2 monthly *LymphAssist* cycles (40 minutes).

Results: The limb is now softer and patient experienced improved flexibility.

Conclusion: The *LymphAssist* cycle on the *Flowtron Hydroven 12* System appears to provide as effective a treatment as MLD.

> *"**LymphAssist** is far superior to any other form of IPC I have previously experienced"*

Summary and abbreviations

Lymphoedema is a chronic, complex and multifaceted condition that affects a significant number of people physically, socially and psychologically. Maintaining quality of life is an important aspect of treatment. Care provision is currently poor but attempts are being made to raise awareness, increase education, develop and maintain clinical services.

The management of lymphoedema should be multidisciplinary and following assessment, Active Compression Therapy (ACT) may complement other aspects of patient treatment. Active Compression Therapy is well tolerated and is an aspect of treatment that can occur in the patient's own home providing symptomatic relief and enhancing patient quality of life.

Abbreviation	Full term
ABPI	Ankle-brachial pressure index
ACT	Active Compression Therapy
AIE	Acute inflammatory episode
BLS	British Lymphoedema Society
DLT	Decongestive lymphoedema therapy
IPC	Intermittent pneumatic compression
ISL	International Society of Lymphology
MLD	Medical/Manual Lymphatic Drainage
SLD	Simple Lymphatic Drainage
SPC	Sequential pneumatic compression

Flowtron Hydroven 3 Therapy System

Flowtron Hydroven 12 Therapy System

In a bid to provide quality systems tailored to meet clinicians and patients needs, The *Flowtron Plus*, *Flowpac*® and *Flowpress*® Systems have been replaced by the *Flowtron Hydroven 12* with *LymphAssist* mode and *Flowtron Hydroven 3* Therapy Systems.

Please contact ArjoHuntleigh if you require further information

Photographic images of patients were supplied by Jane Wigg (Clinical Nurse Manager), Wolverhampton Lymphoedema Service and Sheila Benton-Jones BSc RGN, Clinical Nurse Specialist Tissue Viability, Oxfordshire Primary Care Trust.

Summary and abbreviations

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