Compression Therapy

Pneumatic compression & Garment

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Outline

Definition of compression therapy
Physiological effects of compression therapy
Clinical applications of compression therapy
Contraindications of compression therapy
Potential complication & Precautions of compression therapy
Types of applications techniques

- Compression bandages
- Compression garment
- Intermittent pneumatic compression pump

Objectives

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- Understanding physiological effects of compression therapy

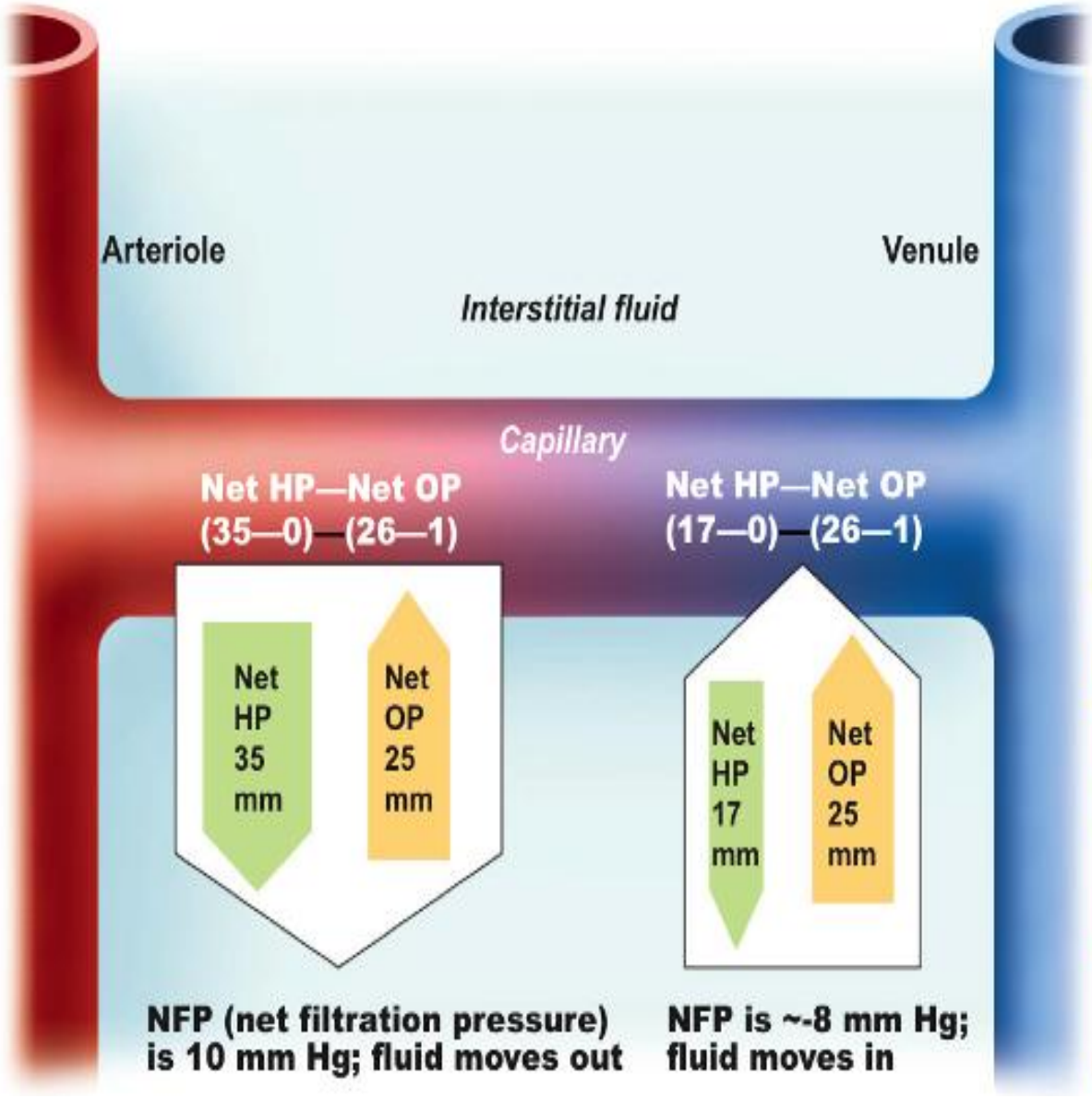
2

- Differentiate the indications, precautions and contraindication of the pneumatic devices

3

- Outline the setup procedure for intermittent external compression.

Functions and structure of lymphatic system



HP = hydrostatic pressure
- Due to fluid pressing against a wall
- "Pushes"
- **In capillary (HP_c)**
  - Pushes fluid out of capillary
  - 35 mm Hg at arterial end and 17 mm Hg at venous end of capillary in this example
- **In interstitial fluid (HP_{if})**
  - Pushes fluid into capillary
  - 0 mm Hg in this example

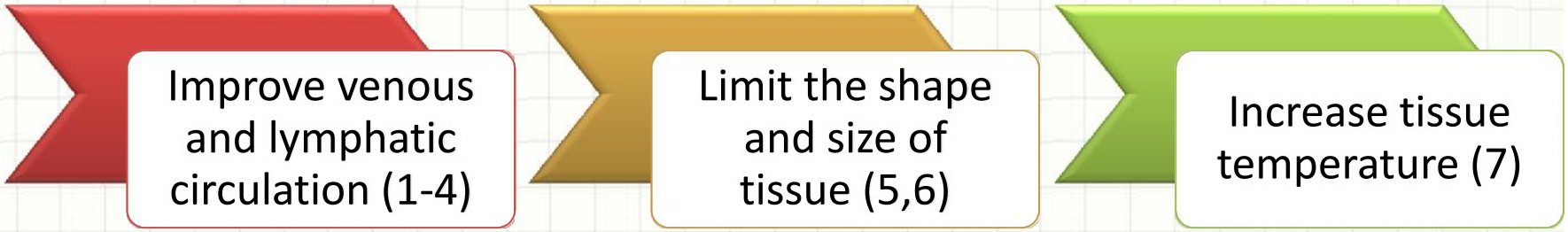
OP = osmotic pressure
- Due to presence of nondiffusible solutes (e.g., plasma proteins)
- "Sucks"
- **In capillary (OP_c)**
  - Pulls fluid into capillary
  - 26 mm Hg in this example
- **In interstitial fluid (OP_{if})**
  - Pulls fluid out of capillary
  - 1 mm Hg in this example

Compression Therapy

Compression is a mechanical forces that increase external pressures of the body part aiming to improve fluid balance of venous and lymphatic circulation and modify scare tissues formation.

Pneumatic compression is the application of external pressure to an extremity through an inflatable appliance (sleeve, gloves or boots) and may be static or intermittent

Physiological effects of compression therapy



1) Improve venous and lymphatic return
2) Reduced the net filtration pressure
3) Improve effectiveness of the muscles pumps during activity
4) Prevents re-accumulation of evacuated lymph fluid
5) Help to break up & soften deposits of connective tissues & scar tissues
6) Provides support for those tissues that have lost elasticity
7) Increase superficial tissue temperature by insulating the area to which it is applied.

Types of Compression Therapy

Compression bandages

- ❖ Inelastic bandages
- ❖ Elastic bandages

Compression garment

- ❖ Custom-made
- ❖ Ready made

Intermittent pneumatic compression

- ❖ Single chamber
- ❖ Sequential chamber

Parameters of Intermittent pneumatic compression

Pump

- All current pumps are electrically driven with a few battery operated.

Parameters of Intermittent pneumatic compression

Inflation pressure

- It is the maximum pressure during inflation time
- Compromise between efficacy and patient comfort
- Correlated with diastolic BP (30-80mmHg)
- Depending on body part treated

  30-60mmHg for upper limb

  40-80 mmHg for lower limb

Parameters of Intermittent pneumatic compression

Inflation/deflation time

Inflation time is period where the compression sleeve is being inflated (30-100seconds)

Deflation time: is period where the compression sleeve is being deflated or is fully deflated (10-50seconds)

Ratio of inflation/deflation time 3:1

In DVT and arterial disease shorter inflation time than deflated time between compressions **Why?**

Parameters of Intermittent pneumatic compression

Total treatment time

- Recommended time is 1-4 hours per treatment for 3times /weeks
- Multiple treatment/day is recommended
- 2-3hours for one or twice a day

2 hours – traumatic edema
2.5 hours (3X/week) - venous ulcers
4 hours (1-3 hour sessions) – residual limb reduction

Parameters of Intermittent pneumatic compression

Sequential chamber compression

Multiple champers

Device contains multiple bladders (2-12) that allows for a single pressure to be applied to parts of the limb in sequence from distal to proximal.

Sequential Circulator

Pressure Range: 0-125mm Hg
Cycle Time: 18secs per chamber
Inflation:72secs
Deflation: 18secs
Used with 4 chamber garment
Bilateral operation available

Parameters of Intermittent pneumatic compression

Static/single chamber compression

Single Chamber:/static

Applies equal amount(uniform) of static pressure to all parts of extremity simultaneously that expands (inflation) and contracts (deflation) applying simultaneously

No pressure gradient exists. (static)

Adjustable pressure range 1-100mmHg

Pre-set inflation/deflation cycle

Clinical applications (indications) of compression therapy

- Primary /secondary lymphedema
- Venous insufficiency
- Venous stasis ulcer
- Residual limb shaping after amputation
- Dysfunction of the muscle pump
- Accelerate wound healing time
- Edema following trauma or sports injuries

1

- Control of peripheral edema/lymphedema

Causes of edema :

- Venous or lymphatic obstruction
- Increased capillary permeability
- Increase plasma volume
- Exercise
- Post-Trauma/ Surgery/Burn

Causes of lymphedema:

Mechanical obstruction of lymphatics system (secondary lymphedema)

Abnormality of lymphatic vessels or lymph nodes (primary lymphedema)

1

- Control of peripheral edema/lymphedema

Adverse effects of lymphedema

- Impaired ROM
- Limitation of function
- Pain
- Increase risk of
  - Infection/Cellulitis
  - Ulceration/Amputation
  - Dermatitis
  - Brown skin pigmentation

1

- Control of peripheral edema/lymphedema

Pressure Range:
UL 30-60mmHg
LL 40-80mmHg
Inflation time : 80-100secs
Deflation time: 25-35secs
Used with 4-12 chamber garment
Treatment time 2-3 hours

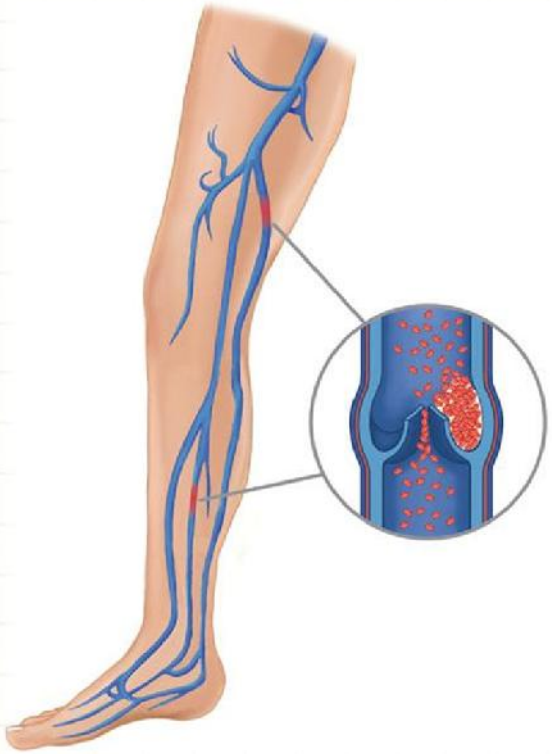
2 • Prevention of DVT

Deep venous thrombosis (DVT) is a blood clot in the deep veins which occur with reduced local circulation, causing pain, swelling and tenderness hotness in the leg

Compression improves venous flow and inhibit thrombus formation

Risk factors for DVT include:

- Older age
- Immobilization
- Surgery
- Trauma
- Paralysis
- Varicose veins



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• Prevention of DVT

For Reusable Sleeve

MODE 1 :
Calf + Foot Sleeve

MODE 2 :
Calf Sleeve

MODE 3 :
Foot Sleeve

MODE 4 :
Thigh + Calf Sleeve

4 • Healing of venous ulcers

Venous Stasis Ulcers (VLU) are areas of tissue breakdown and necrosis that occur in the areas of impaired venous circulation.

Risk factors for VLU include:

- Genetic, Age female/male prolonged standing
- Hormones pregnancy obesity

The mechanism of Compression aims to

- Counteract the force of gravity and reduce venous pooling and reflux this promote the normal flow of venous blood up the leg
- Act on the venous and lymphatic systems to improve venous and lymph return and reduce edema
- Improves tissue oxygenation

4

• Healing of venous ulcers

4

• Residual limb shaping after amputation

Compression therapy

- Control postsurgical edema
- Prevent stretch of the soft tissues by excessive fluid accumulation
- Prepare the limb for prosthetic fitting and weigh bearing

Both static and intermittent compression used for limb shaping, but intermittent compression cause more reduction and shaping in limb size by ½ of time required

Intermittent compression applied with an elastic bandages

Contraindications for Compression Therapy

- Deep vein thrombosis and/or pulmonary embolism
- Acute infection of the affected limb (e.g. cellulitis)
- Severe arteriosclerosis or other ischemic vascular disease ABI >0.8
- Complete obstruction of lymphatic system
- Heart disease, Acute pulmonary edema, Renal failure
- Acute trauma /fracture
- Joint dislocation/ subluxation
- Recent skin grafts
- Compartment syndrome
- Pregnancy
- Gangrene
- Dermatitis

Precautions for Compression Therapy

Precautions

- Impaired sensation
- Uncontrolled hypertension
- Cancer
- Stroke or significant cerebrovascular insufficiency
- Superficial peripheral nerves
- Ischemia
- Wrinkling of stockinette

Tips for Clinical Application of Intermittent Compression

1-Preparation of the Treatment

- Establish the absence of contraindications.
- Remove any jewelry on the extremity being treated.
- Determine the patient's diastolic blood pressure.
- Note the girth measurement of the body part being treated.
- Cover the area to be treated with Stockinet™ or similar material.
- Select the appropriate appliance for the extremity being treated.
- Insert the injured limb into the appliance, and avoid bunching of garments
- For best results, elevate the limb during treatment.
- Connect the appliance to the compression unit.

2-Initiation of the Treatment

Informed consent

Select PRESSURE

-30 to 60 mm Hg for UL

-40 to 80 mm Hg for LL

Select the ON-OFF times.

- A 3:1 duty cycle (e.g., 45 seconds ON, 15 seconds OFF) is often used
- Effects of these ratios has not been substantiated

Select the appropriate TREATMENT TIME.

- Post-traumatic edema: 20 to 30 minutes.
- Lymphedema: several hours.

Inform the individual about the sensations to be expected during the treatment.

Instruct the patient to perform gentle range-of-motion (ROM) exercises during the off cycle, if appropriate

3-Termination of the Treatment

- Reduce the ON time or select the DRAIN mode to remove the air or fluid from the appliance.
- Allow the appliance to deflate
- Gently remove the body part from the appliance.
- Re-measure the circumference of the extremity and determine the amount of edema reduction.
- Apply a compression wrap and any appropriate supportive devices.
- Encourage the patient to keep the limb elevated whenever possible between treatments.

DOCUMENTATION

Type of device Parameters used: settings, duration

Patient position

Goal of treatment (FOR format)

Response of patient

Comb Applications +IPCT

- Combination of cold and compression

Temperature adjustment ranges between 10 - 25oC

- Elevate the extremity
  - Gravity assists in venous/lymphatic return
- Electrical Stimulation
  - Motor-level stimulation provides muscle pump