

## Physiotherapeutic procedure on the example of compression therapy in treatment of venous diseases

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### Abstract

The aim of this study is an attempt to systematise the knowledge about physiotherapy in the process of treatment of vascular diseases, with particular focus on compression therapy. Moreover, an attempt was made to identify elements favouring the effective use of medical devices on the example of compression therapy.

### **Aim of the study:**

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### **Introduction**

#### Vascular diseases

Chronic venous disease (CVD) is defined as a state of impaired reflux of venous blood from lower limbs in a patient examined in a standing position, which occurs secondary to obstructive changes in the veins, excessive widening of veins or dysfunction of the vein valves [1]. The anatomic or functional changes occurring in deep veins, superficial veins and/or in perforators (connect veins) contribute to development of permanently reoccurring venous hypertension [2]. The symptoms of chronic venous disease are both subjective and objective and include the following: the feeling of fatigue/heaviness of legs, tingling, widening of small blood vessels, bulging of superficial veins, skin changes, discolouration of skin, itching of leg skin, pain, swelling of lower limbs, congestive skin inflammation, ulceration. There is a distinction between primary and secondary chronic venous inefficiency. The primary one is closely related to genetic weakening of vein and vessel walls. The patients in later stages of life are often exposed to factors that cause further weakening of vessels. The reasons for secondary chronic venous inefficiency most frequently include occlusion and blood backflow, or both of these condition together, which are changes secondary to venous thromboembolism [1].

Risk factors that have influence on occurrence of the chronic venous disease include: age, gender, profession, obesity, eating habits, obstructions, pregnancy, genetic factors, significant surgeries, antineoplastic treatment.

It has been observed that 35% to 69% people might experience chronic venous inefficiency within three years since going through deep venous thromboembolism; however, after five years this percentage rises and can reach 49% to 100% [1, 2].

#### Physiotherapeutic treatment

The notion of physiotherapy focused on blood circulation dysfunctions (vascular physiotherapy), such as chronic venous disease, is gaining public recognition as a non-invasive treatment method based on therapeutic treatment. Physiotherapists have a significant role to play in prevention and recovery from damage caused by this disease. Early stage treatment which aims to prevent hypertension, reflux and inflammation might alleviate the symptoms of the cardiovascular disease and lower the potential risk of ulceration which is the worst complication of this disease [3].

Numerous techniques can be used in such kind of treatment, for example vascular kinesiotherapy (stretching, strength, aerobic and proprioceptive exercises), breathing exercises, pressotherapy, positioning to improve vascular functions, as well as patients education. Nowadays, physical activity is considered as effective way of prevention and treatment of cardiovascular diseases, and walking as an exercise has become an area of major focus in that matter. Exercises which aim at stimulation of calf muscle pump and improvement of venous haemodynamics are the basis of vascular physiotherapy. Elevation of the lower limb eases the backflow of venous blood by means of gravity.

Chronic venous disease is frequently connected with occurrence of ankle swelling, which in turn leads to limitation of its mobility and to dysfunction of patient's functional capability.

Also breathing exercises are a crucial element because when doing them the patient is encouraged to take the maximum deep breath which leads to gradient difference between the pressure of the abdomen and the chest. Subsequently, this pressure is shifted to the main blood vessels which

improves the blood flow on this level. This kind of exercises activate the diaphragm pump and support the backflow of blood to heart and causes its oxygenation [3]. It is also crucial to use pressure therapy during physiotherapy and after the exercises. Wearing compression stocking or bandage facilitates the positive effect of physical exercises [4].

Education of patients as well as encouraging them to self-care and taking responsibility for the decisions about their health is also a key element of vascular physiotherapy. The remarks of the physiotherapist and the medical personnel should be clearly understood and implemented in everyday life. In 2015 Leal et al. have created physiotherapeutic procedure minute for patients with chronic venous disease, which consisted of a set of exercises including stretching, metabolic, strength, aerobic and proprioceptive exercises. However, as pointed by Freitas et al., functioning and efficiency of strength and aerobic exercises have not been sufficiently demonstrated [4].

Kinesiotherapy of distal body parts, as well as the proper arrangement and elevation of lower limbs, helps the venous blood to flow back. The exercises should be done regularly in equal time periods as this is essential to their effectiveness. In preventive and rehabilitation treatment the following exercises are being used: active exercises of dorsal and plantar flexion of the foot in a frequency of circa 15 times per minute, passive or active exercises of knee or iliac joints in all dimensions depending on the fitness level of the patient [5]. Walk-in-place is also recommended, though its intensity and rhythm should be adjusted to the fitness of the patient. Elevation of lower limbs is a well-known and highly recommended technique for patients with chronic venous inefficiency. Such elevation, for circa 15 cm, positively influences diminishing of venostasis and swellings, and precipitates healing. During this exercise, the volume of the limb and the vascular pressure decreases, while the blood flow rate of microcirculation increases [6]. Limb elevation should also occur during sleeping.

#### Compression therapy

This treatment aims at lowering the pressure of the venous system of the limb, improving microcirculation and strengthening the vessel walls. Compression therapy improves the effectiveness of muscle pump, decreases the venous reflux and, when applied regularly, limits the occurrence of lower limb swelling, especially towards the end of the day. Compression therapy must be used appropriately, meaning that the pressure of the special bandage, or ready-made product material, must be properly selected, bearing in mind the condition of the patient, and maintained. Correctly worn compression is an effective therapy and should help the patient avoid complications in the future [7].

Using external compression leads to improvement of:

- the blood flow in superficial and deep veins,
- effectiveness of calf muscle pump,
- local flow in capillaries,
- partial pressure of oxygen in tissues,
- production of prostacyclins,
- nutrients supply of tissues.

Compression therapy decreases:

- functional capacity of lower limb veins,
- the volume of residual blood in lower limbs in standing position,
- hydrostatic pressure of peripheral veins,
- transitional venous hypertension,
- pains of lower limbs [8].

The pressure of compression therapy should oppose gravity and cause hemodynamic effect. In the case of standing position, the required pressure values are 20-60 mm Hg, while in horizontal position they are lower, namely 10-30 mm Hg. During shin ulceration treatment it is recommended

to use high pressure (40-50 mm Hg) with 60 mm Hg considered a borderline value [7].

Typical pressure caused by pressure dressing is not constant and usually diminishes in time, which is related to the characteristics of the material, while increasing in standing position and during effort of lower limb muscles.

Compression therapy has three forms:

- use of ready-made products with graded pressure (knee-length socks, stockings, tights),
- use of elastic bandage,
- use of intermittent pneumatic massage.

Compression products are divided into four pressure classes:

- I. pressure class 20 - 30 mm Hg
- II. pressure class 30 - 40 mm Hg
- III. pressure class 40 - 50 mm Hg
- IV. pressure class 50 - 60 mm Hg [2, 13]

The abovementioned values indicate the highest pressure on ankle. In the case of products with graded pressure it decreases upwards which can prevent the reflux of venous blood through incompetent valves, thus products of the I and II pressure class are most frequently recommended.

Flexibility is a feature of the bandage enabling it to lengthen due to the pressure put on it.

Depending on this feature, the following bandages can be distinguished:

1. inflexible (with stretch close to 0%),
2. of low flexibility (< 70%; short stretch),
3. of medium flexibility (70 - 140%; medium stretch),
4. of high flexibility (>140%; long stretch). [8]

The capability of the material to return to its original length after the stretch is defined as flexibility. Depending on this characteristic, flexible and inflexible compression therapy system can be distinguished.

The flexible system uses materials of medium or high flexibility, which aim at creating appropriate pressure regardless of the physical activity taken up by the patient. These materials can nullify the influence of the changes in the limb circumference during the use of compression. Additionally, special markers, in the form of circles or squares, might be printed on the elastic bandages, which enable control of the stretch – if it is correct, the markers change into squares or circles. This system of compression is recommended for people with limitations of ankle mobility, with neurologic problems and for patients with dysfunction of muscle pump.

In the inflexible compression system, low flexibility materials are used which, in cooperation with muscle activity, produce variable compression. During contraction, the so-called peak pressure is created, due to which the pressure material supports the work of the limb muscle pump. When being put on, the pressure of the dressing should be higher than when using the flexible compression system. The inflexible system is intended for physically active patients [8].

Compression products with graded pressure are an alternative to traditional bandaging. It is a method that is easy to use and ensures the induction of specific pressure on particular parts of the lower limb during the whole day of wearing the product. The key to the success of using compression therapy is the selection of the degree of pressure and size appropriate to the level of advancement. For this purpose, an experienced person measures the circumference of the lower limb in the morning (when there is no swelling). Ready-made compression products include knee-length socks, stockings and tights. It is also important to measure the length of the limb from the floor level, because these products are available in several length versions depending on the height of the patient. In case of unusual dimensions, many companies offer the opportunity to make tailor-

made stocking or knee-length socks, based on personal measurements [6].

There are also two-piece compression products designed for people with venous ulceration. The inner layer of the fabric is designed to protect the sensitive areas, and the outer layer stretched on it provides adequate pressure.

The use of compression therapy is considered safe as it does not cause side effects. However, among patients with peripheral neuropathy or severe peripheral vascular disease, their use is not recommended, as it may lead to ischemia (and consequently to amputation of the lower limb).

A compression bandage using elastic bands should be put on a lower limb from the toe base up to the of the tibial tuberoses. The compression, similarly to ready-made products, decreases from the ankle to the knee. It is important that the pressure, appropriate for a given level of advancement, is maintained until the next bandage change. [7]

#### Aids for application

Compression therapy is an effective method of treatment of chronic venous disease and prevention of deep vein thrombosis, however, high compression is not applied in case of 42-61% of patients, and medium compression in case of 20-28%. The reasons for not following the recommendations are: incorrect stocking selection, intolerance of pressure, aesthetic factors, problems with application of the stocking, and last but not least the depressive mood of the patient may also have an impact. Difficulties in the establishment of compression products are affected by chronic diseases, reduced strength, lower physical fitness of the patient and impairment of cognitive functions. People who help in patient everyday care face similar problems.

There are many accessories on the market aimed at making it easier for people using compression therapy to apply and remove the stocking. Currently, a kind of material sock, which is used to slide the product onto your leg, is given to almost every pair of stocking or knee socks with a second and higher compression class. It is the simplest solution which is intended for products with open fingers as in such case the material is pulled through the hole. It also requires the patient to lean and stretch the stocking (which can be problematic for people with mobility dysfunctions). Another device facilitating the insertion of compression products is a metal frame with handles, on which the stocking is stretched and then it is put on the leg. This device reduces the need for bending, and by stretching a part of the material at the toes makes it easier to insert the foot and set the heel. However, this device is cannot adapt to a specific size and its design in some cases requires the help of a third party. A tubular device has similar advantages. All of these devices are also helpful for people who have a limited range of mobility in the hip joint. On the market, we can also find a device consisting of a plastic cone, on which we stretch the stocking, and a rubber disc on which we then wind the material. Using it, however, requires mastering a sequence of steps which can be problematic for the elderly and those with impaired cognitive functions.

A study conducted by Kapp et al. on the comparison of two aids for applying and removing ready-made compression products (material and metal frame) showed that these accessories were well accepted by patients. Only 9% of participants did not at the initial stage want to use this type of help. After a 13-week observation period, 34% of participants did not need the assistance, and after 26 weeks it was 37%. [9]

Patients education is important in compression therapy and this is why special programs have been launched in some countries to show how to use available support materials in everyday life. This form has been well received by patients and is of significant support for medical staff. [9]

#### **Conclusions:**

Compression therapy is an effective and easy to use form of antithrombotic prevention. There are many solutions tailored to the severity of the disease and the patient's ability to use it. Aids for wearing compression products are also available. The patient's education is a very important

element that influences the patient's use of therapy. The patient should be aware of the purpose of the pressure dressing (or ready-made product), how to use it properly, and how they can help themselves in case of difficulties.

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