

COMPRESSION BULLETIN

Robert Stemmer Library on Compression Therapy

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To study the correlation between static and dynamic stiffness index of 18 different brands of medical elastic compression stockings (MECS) in the laboratory.
- **Compression for venous leg ulcers**
To give a systematic review of all randomised controlled trials (RCTs) regarding the clinical effectiveness of compression bandages or stockings.
- **Randomized trial of medical compression stockings versus two-layer short-stretch bandaging in the management of venous leg ulcers**
80 patients with venous leg ulcers were included in this study, and ultimately allocated into two comparative groups.
- **Inflammatory cytokine levels in chronic venous insufficiency ulcer tissue before and after compression therapy**
30 legs with venous leg ulcers were treated with high-compression four-layer bandages.
- **A compression bandage improves local infiltration analgesia in total knee arthroplasty**
48 patients undergoing total knee replacement and infiltrated with high-volume (170 ml) of 0.2% ropivacaine analgesia were randomized to receive a compression or a non-compression bandage.
- **Effectiveness of thigh-length graduated compression stockings to reduce the risk of deep vein thrombosis after stroke (CLOTS trial 1): a multicentre randomised controlled trial**
In this outcome-blinded, randomised controlled trial, 2.518 patients who were admitted to hospital within 1 week of an acute stroke and who were immobile were enrolled from 64 centres in the UK, Italy and Australia.
- **Combined intermittent pneumatic leg compression and pharmacological prophylaxis for prevention of venous thrombo-embolism in high-risk patients**
In this review, 11 studies, six of them randomised controlled trials (RCTs), were identified.

Robert Stemmer Library on Compression Therapy was created by Robert Stemmer. It is a complete collection of publications of scientific and medical journals. It consists of three parts:

- Handbook „Compression Therapy of the extremities“, edited by Robert Stemmer in 1999 continuous literature updates, which are regular amendments of the handbook.
- The Compression Bulletin reports about important new publications.
- The table of contents of the Robert Stemmer Library:
 1. Introduction
 2. Historical overview
 3. Anatomy
 4. Venous return
 5. The basis of compression
 6. Mobilization
 7. Compression using mechanical devices
 8. Bandages
 9. Compression stockings
 10. Compression & mobilization strategies

The Library is regularly updated with new publications; a selection is presented in the Compression Bulletin.

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Van der Wegen K, Tank B, Neumann M

Correlation between the static and dynamic stiffness indices of medical elastic compression stockings

BACKGROUND

Stiffness is a parameter characterizing the elastic property of compression devices. It is defined by the increase of interface pressure induced by an increase of the leg circumference and can be assessed in the laboratory but also in vivo on the human leg.

OBJECTIVE

To study the correlation between static and dynamic stiffness index of 18 different brands of medical elastic compression stockings (MECS) in the laboratory.

METHODS

18 brands of MECS were divided into 5 categories (class II round- and flat-knitted, class III round- and flat-knitted and class IV flat-knitted) and tested. To calculate the static stiffness index the tension of the stockings was measured by using the dynamometer of the Institut de Textile France. Dynamic stiffness indices were assessed with a dynamic pressure-determining device built in an artificial leg segment.

RESULTS

There was a good correlation between static and dynamic stiffness indices with higher values for the dynamic indices. Surprisingly static stiffness was independent from compression class and type of knitted fabric. Flat-knitted categories showed the tendency towards a larger variation of static and dynamic stiffness.

CONCLUSION

Stiffness is an important feature in the classification of MECS. The dynamic stiffness index does not have an additional value over the static stiffness index which is much easier to be measured.

COMMENT

Stiffness is one important parameter to explain the difference between the therapeutic efficacies of MECS belonging to the same compression class.

Dermatol Surg 2008;34:1477-85

Chapter 5, 9, Number of references/number of self citations: 12/1, Type of publication: experimental trial, Language: en



O'Meara S, Cullum NA, Nelson EA

Compression for venous leg ulcers

BACKGROUND

It is unclear which compression bandages and garments are effective in treating venous ulcers.

OBJECTIVE

To give a systematic review of all randomised controlled trials (RCTs) regarding the clinical effectiveness of compression bandages or stockings.

MAIN RESULTS

39 RCTs reporting 47 comparisons were included.

- There is reasonable evidence that venous ulcers heal more rapidly with compression than without (7 RCTs).
- Single-component compression is less effective than multi-component compression (6 RCTs).
- Compression systems with 2 components (3 trials) and 3 components (4 trials) suggest better outcome when an elastic component is included.
- Different versions of compression with four-components have similar effectiveness (3 trials).
- Compression with four components is more effective than multi-component compression that includes a short-stretch bandage (6 trials).
- The relative effectiveness of four-layer bandages compared with paste bandages is difficult to assess systems because of differences in the paste systems (5 trials).
- There is no difference in effectiveness between adjustable compression boots and compression bandages (2 trials) or between single-layer compression stockings and paste bandages (2 trials).
- Two-layer stockings appear more effective than a short-stretch bandage (2 trials).
- The relative effectiveness of tubular compression when compared with compression bandages is not clear from current evidence (2 trials).

Several issues like ulcer recurrence, cost-effectiveness, quality of life, pain and adverse events are also analysed.

CONCLUSION

Compression increases ulcer healing rates compared with no compression. Multi-component systems are more effective than single component systems. Multi-component systems containing an elastic bandage appear more effective than those composed mainly of inelastic constituents.

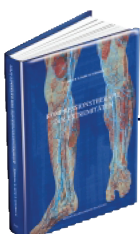
COMMENT

In this 155 pages long updated edition of the Cochrane review the authors have adopted some of the proposals concerning terminology that have been made in a recent consensus document on the classification of compression bandages (Parsch H et al. Classification of compression bandages: practical aspects. *Dermatologic Surgery* 2008;34(5):600–9.)

It is realized that bandage systems are composed of different components being applied in several layers which make comparisons very difficult. This will be a problem also in future trials as long as the pressure of the compression device, which reflects the dosage of the treatment, is not measured. The variability of the interface pressure is more pronounced for compression bandages than for medical compression stockings.

Cochrane Database of Systematic Reviews 2009, Issue 1. Art. No.: CD000265. DOI: 10.1002/14651858.CD000265.pub2.

Stemmer Chapter: 10, Number of references/number of self citations: 80/10, Type of publication: Cochrane review, Language: en



Taraday J, Franek A, Brezinska-Wcislo L, Blaszczyk A, Polak A

Randomized trial of medical compression stockings versus two-layer short-stretch bandaging in the management of venous leg ulcers

AIM

A prospective randomized clinical trial was undertaken to compare medical compression stockings with two-layer short-stretch bandaging in the management of venous leg ulcers. Study endpoints were number of completely healed wounds and the clinical parameters predicting the outcome.

PATIENTS, METHODS

80 patients with venous leg ulcers were included in this study, and ultimately allocated into two comparative groups. (25 women, 15 men). They were treated with compression stockings (25–32 mmHg) and drug therapy. Group B consists of 40 patients (22 women, 18 men). They were treated with short-stretch bandages (30–40 mmHg) and drug therapy, administered identically as in group A.

RESULTS

Within two months the 15/40 Patients (37.50%) in group A and 5/40 (12.50%) in group B were healed completely ($p = 0.01$). For patients with isolated superficial reflux, the healing rates at two months were 45.45% (10/22) in group A and 18.18% (4/22) in group B ($p = 0.01$). For patients with superficial plus deep reflux, the healing rates were 27.77% (5/18) in group A and 5.55% (1/18) in group B ($p = 0.002$). Comparison of relative change of the total surface area (61.55% in group A vs. 23.66% in group B), length (41.67% in group A vs. 27.99% in group B), width (46.16% in group A vs. 29.33% in group B) and volume (82.03% in group A vs. 40.01% in group B) demonstrated difference ($p = 0.002$ in all comparisons) in favour of group A.

CONCLUSION

The medical compression stockings are an extremely useful therapy in enhancement of venous leg ulcer healing (both for patients with superficial and for patients who had superficial plus deep reflux). Bandages are less effective (especially for patients with superficial plus deep reflux, where the efficiency compared to the stockings appeared dramatically low). These findings require confirmation in other randomized trials with long term results.

Phlebologie 2009; 38: 157 – 163



Beidler SK, Douillet CD, Berndt DF, Keagy BA, Rich PB, Marston WA

Inflammatory cytokine levels in chronic venous insufficiency ulcer tissue before and after compression therapy

BACKGROUND

Non-healing venous ulcers are associated with elevated inflammatory cytokine levels. The influence of compression therapy has only scarcely been investigated.

METHODS

30 legs with venous leg ulcers were treated with high-compression four layer bandages. Biopsies were taken from healthy and ulcerated tissue before and after therapy and multiple cytokines were measured by a protein assay. Patients who had a more than 40% ulcer area reduction in 4 weeks were designated as rapid healers and those who healed less than 40% were designated as delayed healers.

RESULTS

In ulcer tissue the majority of pro-inflammatory cytokine protein levels were elevated compared to healthy tissue. Compression therapy reduced these cytokines significantly and induced an up regulation of TGF- β 1 in ulcer tissue. Rapid healing ulcers showed higher levels of IL-1 α , IL-1 β , INF- γ , IL-12p40 and granulocyte-macrophage colony-stimulating factor before compression and IL-1 Ra after therapy. There was a significant decrease of INF- γ after treatment in the rapidly healing patients.

CONCLUSION

Compression therapy leading to ulcer healing is associated with reduced pro-inflammatory cytokine levels and higher levels of the anti-inflammatory cytokine IL-1 Ra.

COMMENT

This is an eminent experimental study showing that the beneficial effects of compression therapy on ulcer-healing can not only be explained by physical and hemodynamic effects, but that there is also an important influence on the level of cytokines and growth-factors.

J Vasc Surg 2009;49:1013-20

Stemmer Chapter: 5, 8, Number of references/number of self citations: 42/1, Type of publication: experimental trial, Language: en, Language of abstract: en



Andersen LO, Husted H, Otte KS, Kristensen BB, Kehlet H

A compression bandage improves local infiltration analgesia in total knee arthroplasty

BACKGROUND

The role of bandaging after total knee replacement to prolong analgesia has not been evaluated after local infiltration of high volumes of analgetics.

METHODS

48 patients undergoing total knee replacement and infiltrated with high-volume (170 ml) of 0.2 % ropivacaine analgesia were randomized to receive a compression or a non-compression bandage. The compression group was wrapped with a padding layer and on top with a strongly applied inelastic adhesive bandage (Acrylastic®), the control group had just soft padding. Bandages were left for 24 hours postop and the pain level was checked using a visual scale repeatedly during rest and mobilization.

RESULTS

Pain at rest, during flexion, or on straight leg lift was significantly lower for the first 8 h in patients with compression bandage than in those with non-compression bandage. Mean hospital stay was similar (2.8 days and 3.3 days, respectively). The positive effect of compression is explained by a reduction of swelling and/or by slower absorption of the local anaesthetic.

CONCLUSION

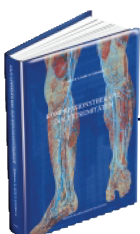
A compression bandage is recommended to improve analgesia after high-volume local infiltration analgesia in total knee arthroplasty.

COMMENT

The findings of this study are in line with the general experience that compression reduces pain after any kind of trauma to the lower extremities.

Acta Orthopaedica 2008; 79 (6): 806–811

Chapter 8, Number of references/number of self citations: 15/1,
Type of publication: randomized controlled trial,
Language: en, Language of abstract: en



Effectiveness of thigh-length graduated compression stockings to reduce the risk of deep vein thrombosis after stroke (CLOTS trial 1): a multicentre randomised controlled trial

AIM

Deep vein thrombosis and pulmonary embolism are common after stroke. The use of low-molecular weight heparin in thromboprophylaxis is limited because of higher risk of bleeding. In different trials the reduction of risk of DVT by wearing antithromboembolic compression stockings postoperatively was shown in patients undergoing surgery. Based on this, antithromboembolic stockings were also recommended in national stroke-guidelines to prevent thromboembolic complications.

METHODS

In this outcome-blinded, randomised controlled trial, 2,518 patients who were admitted to hospital within 1 week of an acute stroke and who were immobile were enrolled from 64 centres in the UK, Italy and Australia. Patients were allocated via a central randomisation system to routine care plus thigh length antithromboembolic stockings (n=1,256) or to routine care plus avoidance of stockings (n=1,262). The primary outcome was the occurrence of symptomatic or asymptomatic DVT in the popliteal or femoral veins.

RESULTS

The primary outcome occurred in 126 (10%) patients allocated to thigh length stockings and in 133 (10.5%) allocated to avoid stockings, resulting in a non-significant absolute reduction in risk of 0.5%. Skin breaks, ulcers, blisters and skin necrosis were significantly more common in patients allocated to stockings than in those allocated to avoid their use 64 (5%) vs. 16 (1%). These data do not lend support to the use of thigh-length antithromboembolic stockings in patients admitted to hospital with acute stroke.

COMMENT

In this study the term «graduated compression stockings» was used to describe the treatment in the stocking group. It has to be mentioned that there are different kinds of compression stockings for different indications on the European and international market. In this study so called antithromboembolic stockings (Tyco Healthcare/Covidien, USA) were used. This kind of stockings must not be mixed with medical compression stockings which are used in the treatment of chronic venous diseases. Medical compression stockings are manufactured in a standardized way in four different compression classes, which differ in ankle pressure. Pressure graduation is varied by the knitting process of these stockings and at least in Europe this process is standardized and quality controlled. Many different studies have shown the benefit of these medical compression stockings in the treatment of different venous diseases (1). In contrary to these stockings antithromboembolic stockings are less standardized and differ widely between the different products from different companies. Most antithromboembolic stockings provide a pressure in the ankle region of about 18 mmHg with a wide variation between different products. In this study no pressure data of the used stockings were provided.

Nevertheless, benefit has been shown for thromboprophylaxis in surgical patients (2). The lack of effectiveness to prevent thromboembolic complications in stroke patients in this study may be due to the fact that these patients have been strictly immobile, not able to use their muscle pump in the legs. This is usually not the fact in other post-surgical patients. The interaction of muscle contractions and external compression plays an important role in enhancement of venous flow. Nevertheless, this is an important study, even if flaws of the study like number of patients and blinding which have been discussed by Barth (3) in the Lancet do exist. Skin



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damage below anti-thromboembolic stockings have been reported in patients with peripheral vascular disease and in diabetic patients (4, 5). A higher proportion of skin damage also occurred in the stocking group in this study. Although peripheral vascular diseases were excluded in this study, this was only based on the judgement of the responsible clinician or nurse. It was not reported that Doppler measurements were undertaken to objectively exclude peripheral arterial occlusive disease. Severe peripheral arterial occlusive disease is a contraindication for external compression especially in bed-rest patients. To exclude those patients for treatment Doppler pressure measurements are the best objective methods.

The results of this study do not support the use of thigh length anti-thromboembolic stockings to prevent thromboembolic complications in immobile acute stroke patients. This does not mean however that these kinds of stockings are not effective in the prevention of thromboembolic complications in other patient groups. In addition anti-thromboembolic stockings should not be mixed with medical compression stockings which are used in the treatment of venous diseases. The term «graduated compression stockings» is unspecific and maybe cause for misinterpretation of the results as has happened in public journals in Germany.

The Lancet 2009; 373: 1958 -1965

Literature:

- 1 Palfreyman SJ, Michaels JA: A systematic review of compression hosiery for uncomplicated varicose veins. *Phlebology* 2009; 24: 13 - 33
- 2 Amaragiri SV, Lees T: Elastic compression stockings for prevention of deep vein thrombosis. *Cochrane Database Syst Rev* 2000; 1: CDOO1484
- 3 Barth, P: Thigh-length compression stockings and DVT after stroke. *The Lancet*; 2009; 373: 1023 – 1024
- 4 Kay TW, Martin FI: Heel ulcers in patients with long standing diabetes who wear anti-thromboembolic stockings. *Med J Aust* 1986; 145: 290 – 291
- 5 Merret ND, Hanel KC: Ischaemic complications of graduated compression stockings in the treatment of deep vein thrombosis. *Postgrad Med J* 1993; 69: 232 - 234



Kakkos SK, Caprini JA, Geroulakos G, Nicolaidis AN, Stansby GP, Reddy DJ

Combined intermittent pneumatic leg compression and pharmacological prophylaxis for prevention of venous thrombo-embolism in high-risk patients

AIM

It has been suggested that combined modalities are more effective than single modalities in preventing venous thrombo-embolism (defined as deep vein thrombosis and pulmonary embolism, or both) in high-risk patients. The aim of this review was to assess the efficacy of intermittent pneumatic leg compression combined with pharmacological prophylaxis versus single modalities in preventing venous thrombo-embolism in high-risk patients. The Cochrane Peripheral Vascular Diseases (PVD) Group searched the reference lists of their Specialised Register (last searched 17 July 2007) and the Cochrane Central Register of Controlled Trials (CENTRAL) (last searched *The Cochrane Library* 2008, issue 3) for relevant articles to identify additional trials. Randomised controlled trials (RCTs) or controlled clinical trials (CCTs) of combined intermittent pneumatic leg compression and pharmacological interventions used to prevent venous thrombo-embolism in high-risk patients. Data extraction was undertaken independently by two review authors using data extraction sheets.

RESULTS

In this review, 11 studies, six of them randomised controlled trials (RCTs), were identified. The trials included a total of 7431 patients. As compared to compression alone, the use of combined modalities significantly reduced the incidence of both symptomatic pulmonary embolism (PE) (from about 3 % to 1 %; odds ratio (OR) 0.39, 95 % confidence interval (CI): 0.25–0.63) and deep vein thrombosis (DVT) (from about 4 % to 1 %; OR 0.43, 95 % CI: 0.24–0.76). When compared with pharmacological prophylaxis alone, the use of combined modalities significantly reduced the incidence of DVT (from 4.21 % to 0.65 %; OR 0.16, 95 % CI: 0.07–

0.34) but the included studies were underpowered with regard to PE. The comparison of compression and pharmacological prophylaxis together with a combination of compression and aspirin showed an insignificant reduction in PE and DVT in favour of the former group. Repeated analysis restricted to the RCTs confirmed the above findings.

CONCLUSION

When compared with compression alone, combined prophylactic modalities decrease the incidence of venous thrombo-embolism significantly. As compared to pharmacological prophylaxis alone, combined modalities reduce the incidence of DVT significantly, but the effect on PE is unknown. The results of the current review support, especially in high-risk patients, the use of combined modalities. More studies on their role in PE prevention, compared with pharmacological prophylaxis alone, are urgently needed.

COMMENT

These results show the significant benefit of a combination of intermittent pneumatic compression and pharmacological prophylaxis in the reduction of thromboembolic events in high-risk patients. These results should lead to the consequence that intermittent compression should be added to the goldstandard of pharmacological prophylaxis in those units dealing with high-risk patients. Actually pharmacological prophylaxis is the standard in most of the institutions which is not the case for pneumatical compression today.

Eur J Vasc Endovasc Surg 2009; 37: 364 – 365

Lit.: 0/0, Publ.: Review, Lan.: Eng; Abstr.: Eng, Chap.: 7



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