

Ease of use and reproducibility of five compression systems

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Venous insufficiency is the most common condition leading to leg ulceration.¹ Internationally, management of the condition varies:

- US: Unna's Boot (a non-compliant zinc paste bandage covered with a cohesive bandage)
- UK: multilayer elastic compression is widely used
- Europe and Australia: inelastic short-stretch bandages are standard practice.

In the autumn of 2005 we undertook a study to compare the ease and reproducibility of pressures under the new Coban 2 Layer Compression System with those of four established systems.

Study outline

- Thirty-two experts in the application of compression bandages were invited to participate (the panel)
- Recruitment and data collection were undertaken over a three-month period
- An artificial leg was used for the pressure recordings
- Three pressure sensors (Kikuhime small probe, MediTrade, Soro, Denmark) were used to monitor and record forces
- Sensors were placed on fixed gel cushions as follows: 10cm above the lateral malleolus (leg circumference: 22cm); 10cm below the top of the bandage (leg circumference: 33cm); in

between (leg circumference: 27cm) (Fig 1)

- Each panellist applied their most commonly used compression system to the sensed artificial leg. Pressures were recorded three times
- Application of the new Coban 2 Layer Compression System was demonstrated and the panellist was given time to 'practise'
- The panellist then applied the new system to the sensed artificial leg and pressures were again recorded three times. Note: in all cases pressures were recorded immediately after each bandage application. Before each application, all pressure sensors were calibrated to a force of 0mmHg
- The time needed from the beginning of each bandage application until completion, for each of the six bandage applications, was recorded
- Four bandage systems were compared directly with the Coban 2 Layer Compression System: Profore (Smith & Nephew), Actico (Activa), Unna's Boot (Graham-Field Medicopaste & 3M) and Rosidal K (Lohmann & Rauscher).

Before and after all bandage applications, each panellist was asked about the compression bandage technique they used most often.

Questions asked before the bandage application included: how much pressure do you believe is provided by your current system? Why do you believe this pressure is provided by this system? Do you measure the pressure?

Questions asked after the series of bandage applications included: how easy was it to reach and reproduce the desired pressure with your current system? How easy was it to reach and reproduce the desired pressure with the Coban 2 Layer Compression System?

Results

Pre-application

- Average number of times usual compression system was routinely used: 6.7 per week (short-stretch 11; Profore 9.8; Actico 2.9; Unna's Boot 3)

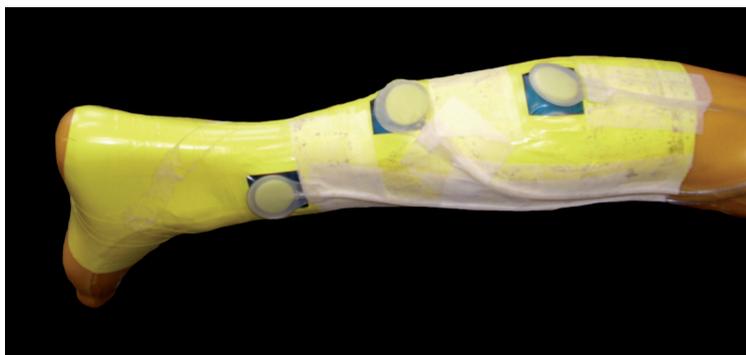


Fig 1. Position of the pressure sensors

Male, 70 years *'If you said to me now this is only an experiment and you would have to go back to the old one, it would devastate me. The new bandages are perfection for me!'*

- 59% believed the system used gave a 'graduated pressure' with a value of 40mmHg at the ankle based on manufacturer's information
- Only one expert had ever used a measuring device in practice.

Post-application: pressures achieved

The panellists applied their usual system three times and then applied the new system three times.

- The pressures provided by the familiar applications were much lower than the applicants expected, especially the pressure values achieved by the Unna's Boot users
- The pressures provided by the Coban 2 Layer Compression System were all higher than the applications the panellists were familiar with
- No bandage application gave true 'graduated compression' as would be expected from the Laplace equation — all values recorded by sensor 2 were higher than with sensor 1.

Pressure reproducibility

The pressure values of the first application were taken as the basis value. Reproducibility was calculated as the percentage difference between the first and second and first and third applications. The statistical software Review Manager 4.2.7 (Cochrane Collaboration 2004) was used to analyse and create the forest plots.

Profore users

Eight panellists normally used this product. We found a significant difference between the reproducibility of pressure when the Coban 2 Layer Compression System was compared with Profore ($p < 0.00001$) (Table 1).

Unna's Boot users

Eight panellists from the US normally used this product. We found no significant difference between the reproducibility of pressure between Unna's Boot and the Coban 2 Layer Compression System ($p = 0.14$).

Table 1. Reproducibility of provided pressures: Coban 2 Layer Compression System versus Profore

	Coban 2 Layer Mean (SD)	Profore Mean (SD)
Sensor 1 (application 2)	7.90 (5.92)	34.62 (24.13)
Sensor 1 (application 3)	10.67 (7.95)	30.92 (14.71)
Sensor 2 (application 2)	5.10 (3.94)	17.35 (13.05)
Sensor 2 (application 3)	5.50 (4.34)	31.80 (17.18)
Sensor 3 (application 2)	10.70 (9.42)	35.37 (38.05)
Sensor 3 (application 3)	8.04 (5.38)	43.28 (26.37)

Table 2. Reproducibility of provided pressures: Coban 2 Layer Compression System versus Unna's Boot

	Coban 2 Layer Mean (SD)	Unna's Boot Mean (SD)
Sensor 1 (application 2)	35.08 (30.16)	54.91 (66.88)
Sensor 1 (application 3)	69.12 (88.61)	45.24 (20.24)
Sensor 2 (application 2)	101.59 (178.42)	64.05 (56.97)
Sensor 2 (application 3)	149.79 (267.89)	53.65 (22.77)
Sensor 3 (application 2)	124.83 (194.81)	38.93 (52.39)
Sensor 3 (application 3)	146.23 (238.97)	45.00 (55.00)

Table 3. Reproducibility of provided pressures: Coban 2 Layer Compression System versus short stretch

	Coban 2 Layer Mean (SD)	Short stretch Mean (SD)
Sensor 1 (application 2)	16.50 (16.35)	54.91 (76.42)
Sensor 1 (application 3)	17.37 (16.26)	59.69 (75.00)
Sensor 2 (application 2)	7.65 (4.74)	81.81 (142.47)
Sensor 2 (application 3)	8.75 (4.64)	76.35 (158.25)
Sensor 3 (application 2)	16.42 (12.91)	36.40 (34.09)
Sensor 3 (application 3)	18.47 (18.78)	31.11 (15.90)

Pressure differences between the three bandage applications were very high in both groups (Table 2). Note: This phenomenon was also observed by Hafner et al.²

Table 4. Reproducibility of provided pressures: Coban 2 Layer Compression System versus Actico

	Coban 2 Layer Mean (SD)	Actico Mean (SD)
Sensor 1 (application 2)	5.13 (3.17)	38.58 (33.10)
Sensor 1 (application 3)	7.33 (4.39)	22.50 (27.41)
Sensor 2 (application 2)	3.34 (2.09)	20.73 (12.66)
Sensor 2 (application 3)	4.05 (3.01)	20.19 (32.30)
Sensor 3 (application 2)	7.97 (5.11)	11.22 (14.79)
Sensor 3 (application 3)	3.70 (4.48)	11.49 (9.25)

Short-stretch (Rosidal K) users

Eight panellist from Germany (four) and the Netherlands (four) normally used this product. There was a significant difference between the reproducibility of pressure between the short-stretch system and Coban 2 Layer Compression System ($p=0.001$) (Table 3). Note: the bandage application techniques varied widely both between the applicators and the countries.

Actico users

Eight panellists normally used this product. There was a significant difference in reproducibility of pressure between Actico and Coban 2 Layer Compression System ($p<0001$) (Table 4).

Post-application questions

After six bandage applications, the panellists were asked how easy it was to reach and reproduce the desired pressure with their current system when compared with Coban 2 Layer Compression System:

- There was no significant difference between the answers of the Unna's Boot, the short-stretch and Actico users. The Profore users, however, judged the ease of reproducibility as significantly higher with Coban 2 Layer Compression System (20/32 said it was 'much better' and 7/32 that it was 'somewhat better'). Note: Likert scale used, 1 = very difficult; 5 = very easy.

Conclusion

This study was performed on an artificial leg, where three sensors were positioned on gel cushions to imitate positioning on soft tissues. Any bandage application to this leg was not influenced by confounding factors such as patient movements, limb position or shape.

Male, 80 years *'I'm less aware of this bandage than I was of the four-layer one. It's quite comfortable, and I can get a sock on over it. With the four-layer bandage, the leg gets very hot and, of course, you're wearing it in bed and it can get very uncomfortable. I'm not aware of this [bandage] at all'*

- The reproducibility of provided pressures with Coban 2 Layer Compression System was significantly 'more accurate' when compared with the currently used systems.

Additionally, this evaluation identified that the system application technique was fast and easy to learn

- It can be concluded that Coban 2 Layer Compression System is easy to use and provides more consistent pressure values than the other four compression systems evaluated.

Potential patient benefits

- The new compression system offers the benefits of sustained compression associated with multilayer systems — the new system has just two layers
- It will enable patients to wear more normal footwear and so improve their mobility opportunities
- The system is likely to be attractive to younger patients with leg ulcers
- All of the above should enhance patients' quality of life.

Potential professional benefits

- All practitioners commented that the new compression system was easy to use and to learn how to apply, and that it felt very secure when applied to their own limb
- All practitioners were able to apply the system more successfully than their more usual compression system
- All patients reported the system to be supportive and comfortable when applied, which enhanced practitioners' confidence in their application technique and their confidence/willingness to use the system again
- All practitioners believed their colleagues would have little trouble understanding the theory underpinning the 'new technique' and in learning how to apply the new system
- Coban 2 Layer Compression System could prove to be very cost-effective for the NHS. ■

References

- 1 Moffatt, C.J., Franks, P.J. A prerequisite underlining the treatment programme: risk factors associated with venous disease. *Prof Nurse* 1994; 9: 9, 637-642.
- 2 Hafner, J., Bottonakis, I., Burg, G. A comparison of multilayer bandage systems during rest, exercise, and over 2 days of wear time. *Arch Dermatol* 2000; 136: 7, 857-863.

Full results are available from Mark Collier on mark.collier@ulh.nhs.uk