

A NEW THERMOPLASTIC CASTING MATERIAL

A Comparison Between Plaster of Paris and Hexelite®

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Plaster of Paris and Hexelite®, a new thermoplastic bandage, were compared in the treatment of 183 patients with malleolar fractures, Colles' fractures or distortions of the finger joints. There were no statistically significant differences between the two types of bandages taking into account the strength of the bandage, the amount of skin damage and the patient's opinion of the bandage.

Hexelite® is seven times more expensive than plaster of Paris, and, in addition, is more difficult to handle. Hence its use has been discontinued.

Key words: economy; plaster of Paris; thermoplastic bandage

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In recent years new bandage materials have been produced in an attempt to replace plaster of Paris in the treatment of fractures and as an orthopaedic bandage. These bandages are often optimistically introduced but seldom evaluated clinically on a large scale. The purpose of this paper is to describe the results of a prospective comparison between a new thermoplastic bandage material called Hexelite® and the conventional plaster of Paris (Cellona 25®) in the treatment of traumatized patients.

METHOD

In the outpatient clinic in the period February 1st 1978 to February 1st 1979, a randomized comparison was made of the two bandage types, using Cellona® plaster on even dates and Hexelite® on uneven dates. The traumatic injuries included in the investigation were:

- a) fractures in the malleolar region treated with a below-knee walking cast;
- b) Colles' fractures treated with a dorsal forearm splint; and
- c) distortions of the proximal interphalangeal joints treated with a circular finger bandage.

Only patients older than 15 years were included in the study. All bandages were applied after swelling had diminished, about a week after the trauma. A uniform stocking on the skin was used in both bandage types and we tried to use standardized amounts of bandage material for the two types. In order to give the plaster walking bandages some water tolerance they were supplied with an outer layer of Cellamine®. The finger bandages were made of Cellamine® only.

On removing the bandages all the patients were examined for maceration of the skin as well as breakage of the bandage. The patient's opinion of the bandage was recorded, i.e., the weight of the bandage, its stability, the skin pressure, and the water tolerance, as well as function of the patient (walking, working) while wearing the bandage.

As the thermoplastic material is rather expensive a comparison of the economy was also made.

The synthetic bandage material

Hexelite® is a thermoplastic polyester material supplied in rolls and also as splints of various sizes from 5 to 15 cm in width. After heating in a water bath to 80°C for 5 minutes the material softens and can be applied. The elastic strength of the material is regained by cooling to room temperature, but the material can be softened again by reheating if it stiffens before use. The application of the warmed material after squeezing off any excess water using towels is almost the same as for plaster. After half an hour of cooling at room temperature the bandage has gained its full strength for use.

RESULTS

A total of 105 patients were bandaged with Hexelite® and 78 with plaster as can be seen in Table 1. The length of time the bandage was applied was equal for the two bandage types. For all the patients the above-mentioned factors were investigated. The results in the three groups, below-knee walking cast, dorsal forearm splint and circular finger bandage, are shown in Tables 2, 3 and 4.

All results were subjected to statistical evaluation by a χ^2 -test with $P < 0.01$. The only significant difference found was a greater water tolerance of Hexelite® when used for dorsal forearm splints and finger bandages.

The costs of the two bandages are shown in Table 5. Hexelite® is seven to eight times more expensive than plaster with Cellona® and Cellamine®. As this fact was known before the investigation was carried out, a record was kept of

Table 1. The distribution in the different groups treated with either plaster of Paris or Hexelite® bandage

	Plaster of Paris	Hexelite®	Total
Below-knee walking cast	18	28	46
Dorsal forearm splint	23	32	55
Finger bandage	37	45	82
Total	78	105	183

Table 2. Results of the comparison of plaster and Hexelite® below-knee walking casts

Below-knee walking casts	Cellona® Plaster	Hexelite®
	Total	28
	18	8
Skin damage	5	8
Repair of bandage	10	8
Patients' opinion:		
Weight, too heavy	5	3
Walking function, good	10	18
Skin pressure, sensation of	4	9
Water tolerance, good	4	15

the cost of transportation in an ambulance from hospital to home for the patients with plaster walking casts. It is usual for outpatients with a wet and still not fully hardened plaster on the

Table 3. Results of the comparison of plaster and Hexelite® forearm splints

Dorsal forearm splints	Cellona® plaster	Hexelite®
	Total	32
	23	32
Skin damage	1	4
Repair of bandage	3	3
Patients' opinion:		
Stabilization, good	19	28
Function of the hand, good	22	28
Painless with the bandage	20	31
Skin pressure, sensation of	6	7
Water tolerance, good	2	16

Table 4. Results of the comparison of plaster and Hexelite® finger bandages

Finger bandages	Cellamine® plaster	Hexelite®
	Total	45
	37	45
Skin damage	6	12
Repair of bandage	6	6
Patients' opinion:		
Stabilization, good	23	17
Skin pressure, sensation of	5	16
Painless with the bandage	26	31
Function of the hand, good	32	39
Water tolerance, good	16	36

Table 5. Cost in Danish Kroner (1979 prices) of the two types of bandages without the underlying Stockinet®

	Costs in Dkr	
	Plaster of Paris	Hexelite®
Walking bandage	25 Dkr	200 Dkr
Forearm splint	4 Dkr	34 Dkr
Finger bandage	1 Dkr	4 Dkr

lower limb to be transported from the hospital to their home by ambulance. By contrast, Hexelite® hardens after half an hour and we therefore tried to diminish the costs of this expensive bandage by letting these patients use public transport to their homes if possible.

The transport costs of the plastered patients by ambulance were on average 120 Dkr (1979 prices) per patient. As the Hexelite® below-knee walking cast cost 175 Dkr more than a corresponding plaster bandage, it was not possible in this way to make the use of the expensive bandage profitable.

DISCUSSION

Application of conventional plaster is technically simple and can be mastered after a short practice. The major disadvantages of plaster are the time taken to dry and harden, its not negligible weight, that it must be kept dry and, in addition, that the theatre must be cleaned after its use.

The thermoplastic bandage on the other hand offers clean working conditions and it is a light bandage with great stability which at the same time tolerates water without losing this stability (Scholze 1977). In this investigation only a slight difference between the two bandage types was noted. With the present number of patients there were no statistically significant differences except for water tolerance. A greater tolerance for water was noted for finger bandages and dorsal forearm splints made of Hexelite® but not for below-knee walking casts. One would imagine that a wet walking bandage whether Hexelite® or plaster containing two layers of wet Stockinet® would feel less comfortable in the northern climate.

As regards the application of Hexelite® there were several disadvantages, as previously published by Angel et al. (1979). The necessary temperature, 80°C, feels very hot even after squeezing out the excess water in the meshwork and it was necessary to use gloves especially when applying several bandages. The patients did not feel the temperature, because the skin was protected by two layers of Stockinet®. Like

Bachmann (1977) we feel that the material is not as plastic to apply and is more difficult than plaster to mould exactly around bony prominences. A particular nuisance is the intermediate plastic tape in the rolls which has to be removed during the application and this requires an extra hand. Also the period of time one is able to mould Hexelite® is rather short because the material stiffens gradually on cooling, and even after the most accurate application sharp prominences from the meshwork can not be totally avoided and the patients often complained of wear on their clothes.

The thermoplastic material is radiolucent, but in contrast to other authors (Hipp et al. 1977, Bachmann 1977) we found that a fracture line could be difficult to estimate because the meshwork of the material was visible on the X-rays.

As previously mentioned Hexelite® is about eight times more expensive than plaster and even when counting the costs of ambulance transportation plaster was found to be less costly. We therefore have abandoned the use of Hexelite® except for special purposes.

The advantages of Hexelite® such as its light weight, plastic strength and tolerance for water are probably best utilized in correcting and stabilizing bandages for rheumatic diseases and for orthopaedic conditions in childhood, but it offers no advantages in the treatment of fractures.

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