

## Hexcelite<sup>(R)</sup> versus plaster of Paris: a controlled trial of the below-knee walking cast

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### Abstract

Hexcelite<sup>(R)</sup> and plaster of Paris below-knee walking casts were compared in a controlled clinical trial, involving 82 patients.

Fewer bandage complications, problems and better comfort was found with Hexcelite compared to plaster of Paris ( $P < 0.05$ ). If all costs relating to materials, transportation, complications and extra visits due to these, were taken into account, plaster of Paris was found more expensive than Hexcelite<sup>(R)</sup>. Based on the above an increased use of Hexcelite<sup>(R)</sup> is recommended.

### Introduction

Over the years various types of plaster of Paris have been developed (Nielsen et al, 1973), as well as alternative bandage materials such as polyurethane and Hexcelite<sup>(R)</sup> (a thermo-plastic polyester). Of these, Hexcelite<sup>(R)</sup> has found favour in Danish orthopaedic departments but only as an alternative to plaster of Paris in those special cases where a lighter bandage is indicated, (Nielsen, and Lauritzen, 1981; Rosetzsky, 1982). The argument for not using Hexcelite<sup>(R)</sup> is mainly based on the work of Nielsen and Lauritzen (1981) who reported that Hexcelite<sup>(R)</sup> bandages were more expensive and more difficult to apply than plaster of Paris. The authors' experience however, is that there are more bandage complications and problems using plaster of Paris than with Hexcelite<sup>(R)</sup>. As patients treated by using Hexcelite<sup>(R)</sup> seemed to be more satisfied, the authors' have questioned, whether it really is more profitable, in the long run, to avoid using Hexcelite<sup>(R)</sup>.

A randomized trial was designed, with the aim of comparing Hexcelite<sup>(R)</sup> and plaster of Paris (Cellona), when used for the most frequently

applied bandage in the out-patient clinic, the below-knee walking cast. This weight-bearing cast demands the optimum of material and comfort.

### Patients and methods

During the period 1st January to 31st December 1983, 82 patients in the out-patient clinic took part consecutively in the investigation, having given their informed consent. Excluded from the investigation were patients who were specifically prescribed Hexcelite<sup>(R)</sup>, patients with limited mobility and patients with acute injuries of less than 24 hours—due to post-traumatic oedema. All bandages were applied by random sample by the same technician, who had wide previous experience with plaster of Paris and Hexcelite<sup>(R)</sup>. All bandages were applied according to the manufacturer's instructions.

The number of bandages and application time was recorded, and the patient was given a form, so that technical changes or improvements could be recorded at any subsequent consultation due to complications, as could the appointed removal of the bandage at the clinic. After removal of the bandage, the patients were given a final examination for bandage problems or sequelae, and were interviewed about comfort and activity level.

Eleven out of the 82 patients were excluded, three because of incomplete information, and eight who were lost at follow up. Thus the final material consisted of 71 patients (87 per cent)—34 with plaster of Paris (10♀/24♂) and 37 with Hexcelite<sup>(R)</sup> (10♀/27♂), mean age 34.8 years, range: 15-70 years.

The 34 plaster of Paris and 37 Hexcelite<sup>(R)</sup> patients were comparable as far as sex, age, activity level, bandage wearing time (3.9 weeks for plaster of Paris and 4.0 weeks for Hexcelite<sup>(R)</sup>) and reasons for treatment were concerned. (malleolar fracture, ligamental rupture and rupture of the Achilles tendon).

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The results have been prepared statistically with chi-square test and Fischer's exact test.

### Results

The mean application time was 20 minutes for plaster of Paris, 21 minutes for Hexcelite<sup>(R)</sup>.

#### Bandage complications

As seen in Table 1, 46 per cent (16) of the plaster of Paris patients and 19 per cent (7) of the Hexcelite<sup>(R)</sup> patients ( $P < 0.05$ ) had bandage complications, which were mainly broken plaster of Paris at malleolar level and loose foot plates (seen in both groups). With plaster of Paris, re-application of a complete new below-

Table 1. Bandage complications  
Hexcelite<sup>(R)</sup> versus plaster of Paris.

Type (T)	Complications (% of T)	No Complications (% of T)	Total (%)
Plaster of Paris	16 (46)	18 (54)	34 (100)
Hexcelite	7 (19)	30 (81)	37 (100)
Total	23 (32)	48 (68)	71 (100)

( $p < 0.05$ , Chi square test)

Table 2. Bandage problems  
Hexcelite<sup>(R)</sup> versus plaster of Paris.

	Swelling	Irritation	Abrasion	Sensory loss	Total	Problems (% of Total)
Plaster of Paris (Total=34)	5	3	3	1	12	(35)
Hexcelite (Total=37)	1	0	1	0	2	(5)
Total (nT=71)	6	3	4	1	14	(20)

( $p < 0.05$ , Fischer's exact test)

Table 3. Bandage comfort  
Hexcelite<sup>(R)</sup> versus plaster of Paris.

Type (T)	Good (% of T)	Fair (% of T)	Poor (% of T)	Total (%)
Plaster of Paris	17 (53)	11 (34)	4 (13)	32 (100)
Hexcelite	35 (95)	2 (5)	0 (0)	37 (100)
Total	52 (75)	13 (19)	4 (6)	69 (100)

( $p < 0.05$ , Fischer's exact test)

Table 4. Bandage economy (DKK)  
Hexcelite<sup>(R)</sup> versus plaster of Paris

	Material costs	Transportation costs	Extra visits	Total cost
Plaster of Paris	83	132	118	333
Hexcelite <sup>(R)</sup>	218	31	47	296
Ratio (P/H)	1:2.6	1:0.2	1:0.4	1:0.89

knee walking cast was often necessary, while most of the Hexcelite cases could be repaired by heating and remodelling.

No patients had thrombo-embolic complications or prolonged bandage time. Complications due to the bandage were seen in 20 per cent (14/71) (Table 2). These were significantly more frequent with plaster of Paris ( $P < 0.05$ ).

Bandage comfort with Hexcelite<sup>(R)</sup> was found to be significantly better ( $P < 0.01$ ) than with plaster of Paris (Table 3).

#### Bandage economy

The associated expenses can be divided into the following items:

- 1) Material costs.
- 2) Application time.
- 3) Transportation costs.
- 4) Costs of extra consultations due to problems/complications.

The average total material cost for Hexcelite<sup>(R)</sup> was found to be 2.6 times that of plaster of Paris (Table 4). There was no difference in the application time. The

transportation costs varied from area to area, so the calculations in Table 4 are based on an average of 241 DKK for stretcher cases, 142 DKK for patients able to sit up in an ambulance and 126 DKK for transportation by taxi.

For extra visits to the clinic or emergency ward a previously calculated cost of 250 DKK (Sonne-Holm and Sørensen, 1977) has been used. When all costs are taken into consideration, Hexcelite<sup>(R)</sup> expenses were found to be 0.89 times that of plaster of Paris.

### Discussion

The results reveal a great number of bandage complications and problems. The reliability of these figures is difficult to evaluate, since the only other reference is Rosetzsky (1982), who found bandage complications in 36 per cent (8/22) of his polyurethane forearm casts. In this trial an attempt has been made to reduce the application bias to a minimum, as all casts were applied by the same professional bandage technician, and the findings seem to confirm the hypothesis that initiated the study, namely that there are more complications and problems with the below-knee walking cast made of plaster of Paris than with Hexcelite<sup>(R)</sup>.

Hexcelite<sup>(R)</sup> has previously been criticised (Bachmann, 1977; Nielsen and Lauritzen, 1981), because it was found more difficult to apply than plaster of Paris, especially due to the following: 1) It stiffens more quickly than plaster of Paris (after 1 to 2 minutes), which may cause problems in accurate anatomical application. 2) The temperature of the water, 65°C, in which Hexcelite<sup>(R)</sup> is kept, may cause problems during application. 3) The intermediate plaster tape in the Hexcelite<sup>(R)</sup> rolls delays application. In practice these criticisms were found to be justified, but experience with the material demonstrates that the disadvantages can be reduced, and the first can be used positively, if only one is aware of it; fast bandage stiffening can be employed for quick anatomical application, without pressure marks. The warm water problems can be reduced by using smooth gloves, careful squeezing out of excess water and covering the part of the patient closest to the bandage with a towel. The intermediate plastic tape can be removed by an assistant. In the new Hexcelite<sup>(R)</sup> it has been removed.

Another reason for Hexcelite being considered difficult to use, is lack of training and experience in its application. It appears from Nielsen and Lauritzen (1981), that only 18 Hexcelite below-knee walking casts had been applied in a year (and most probably not by the same person).

The material cost of Hexcelite<sup>(R)</sup> was found to be 2.6 times the price of plaster of Paris, but when expenses for transportation and complications were taken into account, plaster of Paris was found to be 1.13 times more expensive than Hexcelite<sup>(R)</sup>. Furthermore the use of Hexcelite<sup>(R)</sup> must mean fewer days off work for the patients.

### Conclusion

Based on the above results, the Hexcelite<sup>(R)</sup> below-knee walking cast was found to have significantly better bandage comfort, with fewer complications and problems, was less expensive than plaster of Paris, and thus serves the patient and society best. For these reasons an increased use of Hexcelite<sup>(R)</sup>, is recommended together with research in the area of alternatives to plaster of Paris.

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