

Study Title

COMPARISON OF 3 BANDAGE MATERIALS  
FOR COOLING EFFICACY

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**All work presented within this report was carried out in accordance with  
GLP / OECD guidelines**

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## **1. Introduction**

This series of experiments is set out to evaluate and compare the cooling efficacy of 3 bandage materials in combination with a proprietary cooling solution.

The three bandage types selected were a Physicoool bandage, a “TubiGrip” type bandage and a neoprene cored sports bandage. The comparison was conducted by applying each bandage to the forearm of a test subject and monitoring the skin temperature at 60 second intervals until the cooling effect was exhausted.

For the purposes of this experiment the exhaustion point was defined as the point at which the skin temperature of the test subject returned to the stable value recorded prior to the application of the bandage.

One litre of the cooling solution formulation was prepared 36.0g of each test bandage was placed in a separate metalised film sachet to which 90ml of the cooling solution was added. The sachet was then sealed and left to stand for 24 hours at 20°C, to ensure the maximum uptake of liquid.

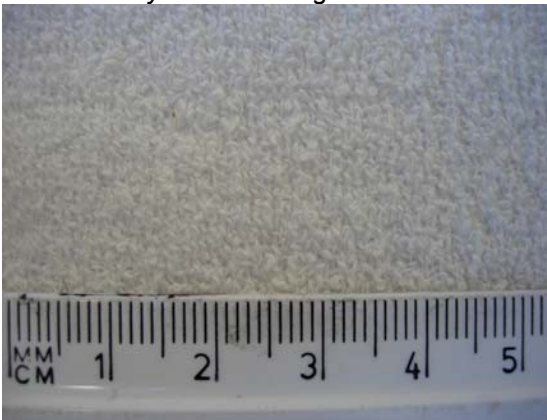
## 2. Product specification and appearance

Appearance Clear light blue mobile liquid

### 2.1 Physicool Bandage

Composition Cotton 100%

*Plate 2.1 Physicool Bandage*



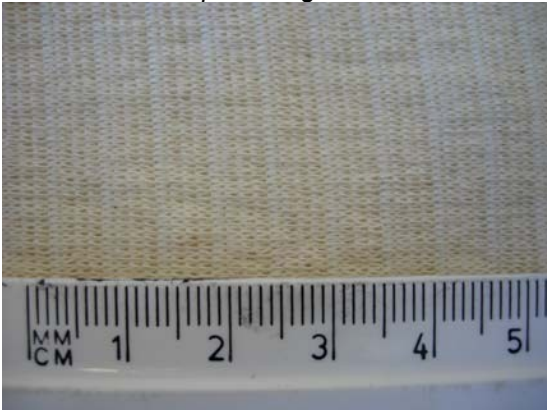
### 2.2 “TubiGrip” Bandage

Composition Cotton 83%

Elastodiene 8%

Polyester 8%

*Plate 2.2 TubiGrip Bandage*



### 2.3 Neoprene Sport Bandage

Composition: Neoprene Blend 70%

Nylon Jersey Knit 30%

*Plate 2.3 Neoprene Sport Bandage Skin side (top ) Outer Side (bottom*



### **3. Test Method**

The experiment was conducted in an environmentally controlled room under the following conditions: temperature  $20\pm 1^{\circ}\text{C}$ , relative humidity  $45\pm 2\%$  and average air flow  $0.5\text{ms}$ .

Prior to each test run the subject was kept at rest for 30 minutes. At time zero a contact thermocouple was applied to the skin of the test subject and secured in place on the inside of the forearm, 10cm above the wrist, with surgical tape.

At 10 minutes the bandage was applied. The bandage remained in place until the subjects skin temperature returned to its starting value. From the time of initial application of the bandage to the end of the run the output of the thermocouple was recorded electronically at an interval of 60 seconds using a Dickson data logger coupled to a PC, running DicksonWare v9 software, via an RS232 serial link.

During the trial period the subject was kept in a resting state. An additional test was performed, for comparison purposes, using a sample of the crape bandage without any cooling solution in this case the bandage was left in place for 60 minutes.

Each test run was separated by a period of not less than 24 hours to ensure that the test subjects arm had returned to normal blood flow, volume and temperature.

## 4. Results

Table 4.1

| Bandage Type   | Cooling Duration | Average skin temperature |
|----------------|------------------|--------------------------|
| Tubigrip       | 275 minutes      | 30.0°C                   |
| Physicool      | 231 minutes      | 24.8°C                   |
| Neoprene Sport | 98 minutes       | 28.3°C                   |

Fig 4.1 Physicool bandage without cooling solution

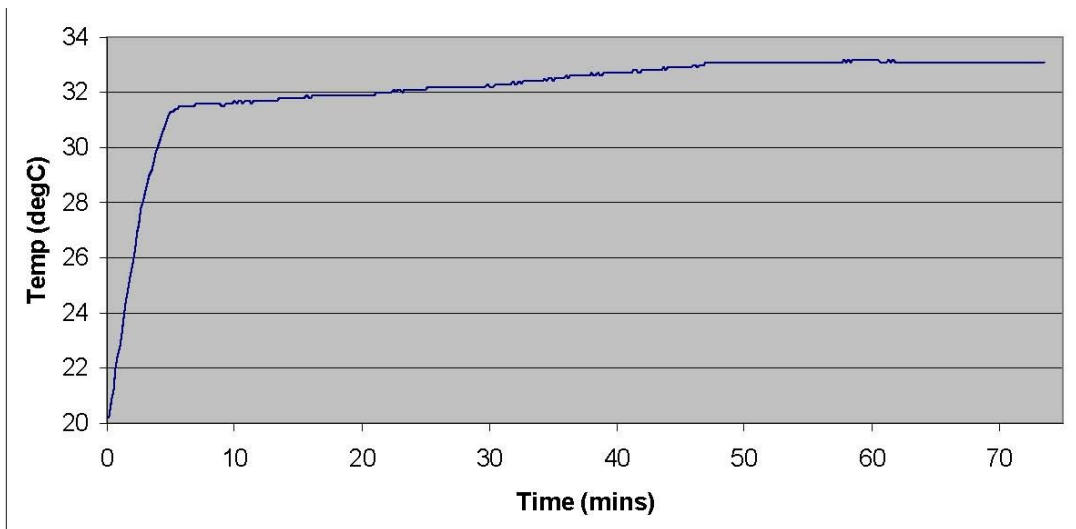
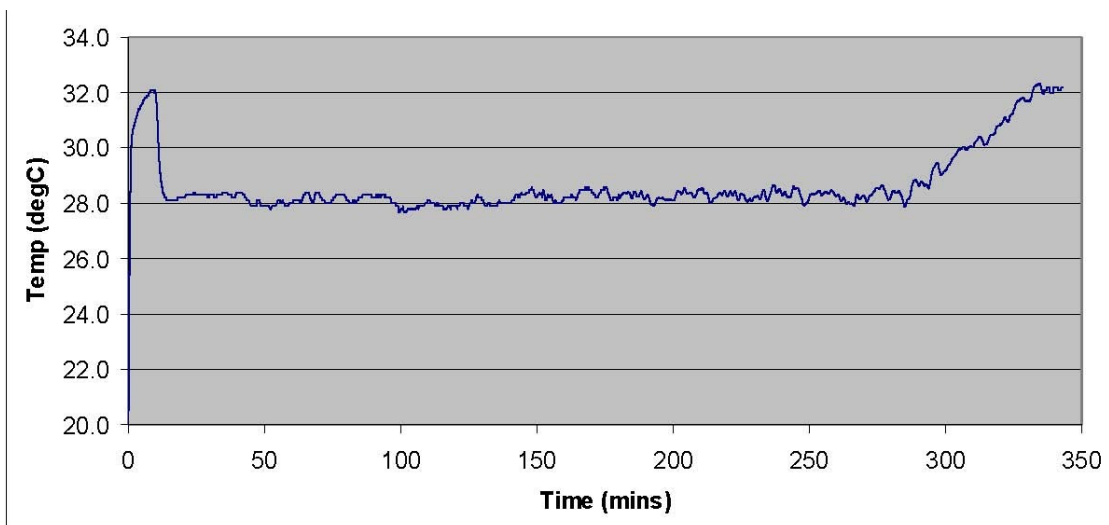
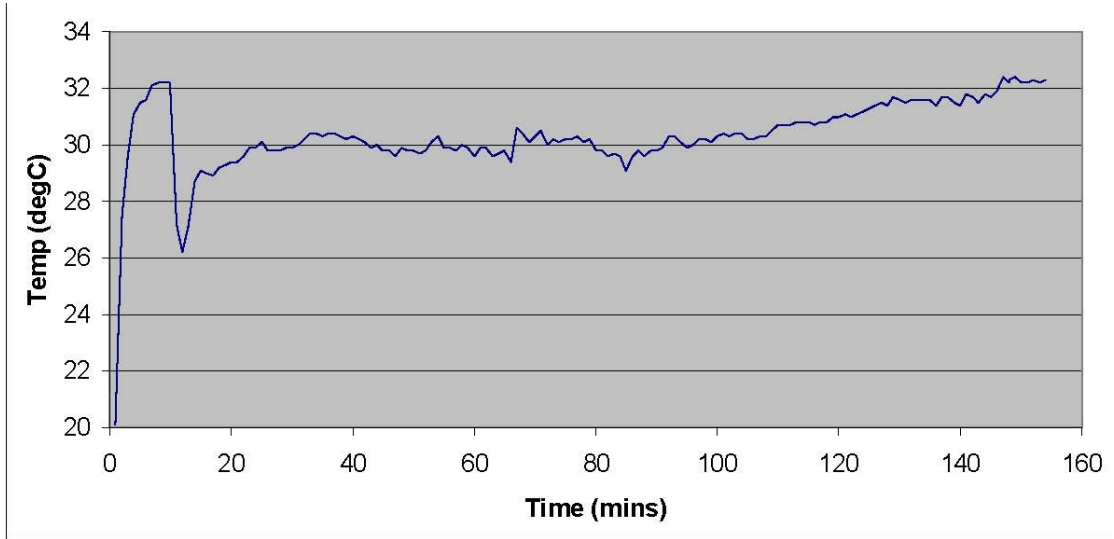


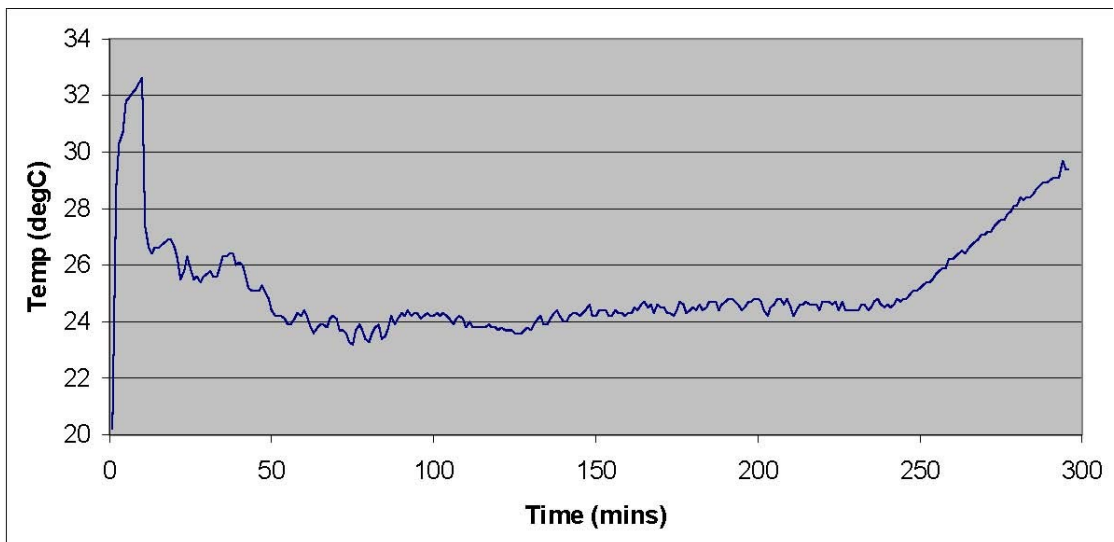
Fig 4.2 Tubigrip bandage



**Fig 4.3 Neoprene Sport Bandage**



**Fig 4.4 Physicool bandage with cooling solution**



## 5. Discussion

With reference to figure 4.1 application of an untreated bandage resulted in the skin temperature increase of 1.4°C this is the result of the modest insulation properties of the bandage when applied to the skin.

With reference to table 4.1 and figures 4.2 through to 4.4 that the greatest cooling effect was provided by the treated Physicool bandage producing an average skin temperature of 24.8°C this represents a drop of 7.4°C relative to initial skin temperature. The Tubigrip bandage cooled the skin to 28.3°C a drop of 3.9°C while the neoprene sport bandage only cooled to 30°C a drop of 2.2°C. For duration of cooling the Tubigrip bandage outperformed the Physicool cooling for 275 minutes and 231 minutes respectively, the neoprene sport bandage only lasted for 98 minutes.

Comparing the performance of the treated Physicool bandage and the TubiGrip bandage, while both are long lasting, it is noticeable that the treated Physicool provides a significantly greater temperature drop.

The poor performance of the Neoprene bandage, both in terms of temperature drop and cooling duration, is due to a number of factors. Firstly the bandage itself could not absorb the full 90ml of cooling solution, 44.2ml was left in the sachet after removal of the bandage this is entirely due to the construction of the bandage. The core comprising 70% of the total mass of bandage is foamed neoprene rubber which though porous takes up very little liquid. Almost all of the liquid capacity of the bandage is within the jersey knit layer on the skin contact side and the thin bonded fabric layer on the outer surface of the bandage comprising a total of 30% of the mass of the bandage. The second factor leading to poor observed performance is that neoprene is a highly effective thermal.

Insulator (thermal conductivity 0.19 (W/mK) at 25°C) the bandage therefore traps body heat counteracting the cooling effect. The third factor is related to the first, with the majority of the cooling solution absorbed on to the jersey knit fabric on the skin contact side of the bandage the liquid and any vapours from it are effectively trapped between the skin and the relatively impermeable neoprene foam, it was noted on removal of the bandage that the interior surface still contained a significant quantity of the cooling solution.

## 6. Conclusions

- The Physicool bandage provided the greatest cooling effect, cooling the skin to 24.8°C.
- The Tubigrip bandage was effective for the longest duration of 275 minutes.
- The Neoprene sport bandage is a poor choice for this application.