

**STUDY ON INTERFACE PRESSURE OF MEDICAL
BANDAGES**

by

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Department of Textile Technology

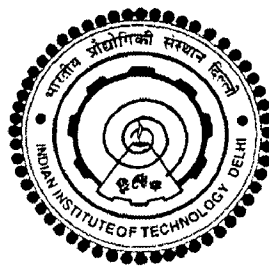
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CERTIFICATE

This is to certify that the thesis entitled “**Study on Interface Pressure of Medical Bandages**” submitted by **Mr. Bipin Kumar** to the **Indian Institute of Technology Delhi** for the award of the degree of **Doctor of Philosophy**, in the Department of Textile Technology, is a record of bonafide research work carried out by him. Mr. Bipin Kumar has worked under our guidance and supervision and has fulfilled the requirements for the submission of this thesis.

The results contained in this thesis are original and have not been submitted in partial or full, to any other university or institute for the award of any degree or diploma.



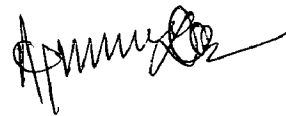
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ABSTRACT

The compression treatment by a medical compression bandage is undoubtedly dependent on the interface pressure developed in the interface between bandage and skin. This interface pressure depends on the complex interaction of many factors – bandage characteristics, limb geometry, application technique and physical activity taken by the patient. The present thesis addresses these issues by studying influence of several parameters on interface pressure to elucidate the compression management.

Interface pressure measurement has been done using a leg-segment prototype designed and developed to obtain interface pressure exerted by a bandage on air bladders placed on mannequin leg. It has been noticed that the initial interface pressure applied by a bandage increases with increasing applied force and number of bandage layers. Higher interface pressure value was measured at lower limb circumference. Under dynamic conditions of the mannequin leg, it has been found that bandage extensibility, applied force and change in circumference of the mannequin leg significantly affect the extra interface pressure that is generated due to extension variation in the bandage. Short-stretch bandages showed higher pressure peaks during movements as compared to long-stretch bandages. Extra interface pressure was found to be larger with increasing the change in circumference of leg and applied force.

Continuous monitoring of the interface pressure showed that the interface pressure decreases over time. Cotton compression bandages showed more than 30% reduction in the interface pressure within 8 hr of wrapping. Reduction of the interface pressure

was found to be higher in dynamic state of the mannequin leg as compared to static state. Increasing the step size of the mannequin leg resulted in more pressure reduction over time. More pressure reduction was obtained at high level of applied force. Increasing thread density and providing elastomeric yarns in the bandage structure resulted in longer sustenance of interface pressure.

It was also found that the interface pressure after application of the bandage was highly correlated with the stress relaxation of the bandage under constant deformation. Various viscoelastic models were developed using stress relaxation parameters to describe the interface pressure profile generated by a compression bandage during the course of compression treatment. Prediction of the interface pressure profile using various model parameters were in agreement with the experimental data.

The knowledge of interface pressure variation provided in present thesis would help in reaching a better understanding of the clinical outcomes of a particular compression product when used under different conditions. This knowledge is of most importance to the bandage manufacturer as well as the doctor administering the treatment for evaluating different compression bandages and recommending the ideal bandages for the compression therapy.

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