"Application of Lycra in Heart Prostheses"

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Abstract

Requirements of fabrics used in heart prostheses

Requirements specified for implants with regard to duration of contact with human body where the contact medium and the intended biostability of the material are stricter compatibility than those for operating. Theatre textiles and products which are used in direct contact with the central nervous system or in the immediate vicinity of the heart or those which are deliberately dissolved in the body .The most important general requirement of heart prosthesis is the compatibility of the material to the human body and the ease with it can be sterilized .

Biocompatibility requirements

1-Blood compatibility where blood compatibility is necessary in fabrics used in heart prostheses, blood compatibility implies that fabrics should not cause thrombosis, which is the clotting of blood formed within a blood vessel .In addition to must not elements of the blood such as the red blood cells, white blood cells and platelets . change in blood composition and blood properties (blood clothing haemolysis)

2-Should not cause alteration of the plasma proteins, destruction of the enzymes, depletion of electrolytes, damage to adjacent tissue or destruction of the cellular

3-No triggering of immunological reactions and allergies

4- No causing of unusual foreign body reaction

5- No cytotoxic reaction.

6- No mutagenic, teratogenic or earunogenic reaction

7- No undesirable biodegradation

8-Be sterility

9-Freedom from pyrogens

10-Load- elongation characteristics compatible with the tissue being replaced

11-Inter operative length matching of the prosthesis

12-Availability in suitable dimensions

The experimental Work

This study aimed to produce fabrics used in heart prostheses (patches , valves frames and vasculars) by using Lycra covered with polyester for different woven structures were used in this research to produce samples as follow:

Regular hopsack 2/2, twill weave 1/3 , satin weave 4 and double weave

Finishing treatment

The produced fabrics were undergoing special treatments before being used. These treatments include crimping ,coating with Chitosan, and then sterilization as following.

Crimping

Crimping is affected by the application of internal steam pressure in a mould designed according to the required configuration .The formation of an accordion pleat which were made permanent by heat-setting at 30ºc for 30 min. The process normally produces a circular crimp, the technique is especially suited to velour grafts since the velour feature is well preserved .Crimping improves the grafts bending ability without kinking , besides reducing the likelihood of kinking crimping has added advantage of improving the longitudinal compliance , and vascular handle .

Coating

The fabric samples were padded in an aqueous solution containing 12% Chitosan, solution then squeezed to a wet pick up 100 %. The fabric samples were dried at 85 o C for 5 min, then thermo- fixed at 140 o C 90 sec .

Sterilization

The fabric samples were sterilized by ethylene oxide gas, where ethylene oxide gas is a colorless gas. It applied in special autoclaves under carefully controlled condition of temperature and humidity .The gas alters proteins, killing bacteria, fungi spores and viruses. A through cleaning cycle is required before sterilization and a gas removal cycle is needed before use.

Patches and valves results

Air permeability

It is clear from the diagrams that irregular hopsack 2/1 has obtained the highest rates of thermal isolation, whereas twill 1/2 has obtained the lowest rates but the difference is insignificant.

It is also obvious from the statistical analysis of the air permeability results that there is an inverse relationship between number of ends and picks per cm and air permeability. I can report that the increasing in ends and picks cause an obstruction in air passage, causing decreasing in air permeability.

Water permeability

It seen from the tables that the regular hopsack 2/2 have obtained the highest rates of water permeability , followed by twill 1/3 and then satin weave .This is for sack of the increase of the number of intersections per cm for the hopsack 2/2 weave which cause increasing of the air spaces in the fabric .so air spaces in the fabric will be increasing causing increasing in the water permeability .

Vascular results

Air permeability

It is obvious from the statistical analysis the air permeability results that there is an inverse relationship between number of picks and ends per cm and air permeability, where samples with 150 ends per cm and 144 picks per cm have achieved the lowest rates of air permeability, whereas samples with 100 ends per cm and 72 picks per cm have achieved the highest rates. This is for sake of that the more yarns per cm the more compacted the fabric become which cause decreasing in air permeability.

After treatment

It obvious from the results that All treated samples have prevented air and water from passing through them, and so blood was prevented from passing. An insignificant changes have occurred to the samples after being coated. Where the coating fill the spaces in fabrics