Artificial Human Skin has Optimized Biomechanical Properties

Scientists from the University of Granada, Spain, have generated artificial human skin by tissular engineering based on agarose-fibrin biomaterial. The artificial skin was grafted onto mice, and optimal development, maturation and functionality results were obtained. This finding will allow the clinical use of human skin and its use in many laboratory tests on biological tissues — which, additionally, would avoid the use of laboratory animals. Further, the finding could be useful in developing new treatment approaches for dermatological pathologies.

The researchers first selected the cells that would be employed in generating artificial skin. Then, they analyzed the evolution of the *in-vitro* culture and, finally, they performed a quality control of the tissues grafted onto nude mice. To this purpose, several inmunofluorescence microscopy techniques had to be developed. These techniques allowed researchers to evaluate such factors as cell proliferation, the presence of differentiating morphological markers, the expression of cytokeratin, involucrine and filaggrin, angiogenesis and artificial skin development into the recipient organism.

The research was conducted by José María Jiménez Rodríguez, from the Tissular Engineering Research group of the Department of Histology of the University of Granada, and coordinated by professors Miguel Alaminos Mingorance, Antonio Campos Muñoz and José Miguel Labrador Molina.

Human skin samples
To make this assay, the researchers obtained human skin from small biopsies belonging to patients following surgery at the Plastic Surgery Service of the University Hospital Virgen de las Nieves in Granada. To create artificial human skin, human fibrin from plasma of healthy donors was used. Researchers then added tranexamic acid — to prevent fibrinolysis — and calcium chloride to precipitate fibrin coagulation, and 0.1% aragose. These artificial-skin substitutes were grafted on the back of the nude mice, with the purpose of observing its evolution *in vivo*. The equivalent skin substitutes were analyzed by transmission and scanning light and electron microscopy and inmunofluorescence.

The skin created in the laboratory showed adequate biocompatibility rates with the recipient and no rejection, dehiscence or infection was registered. Additionally, the skin of all animals used in the study started to show granulation after six days from implantation. Within the following 20 days, cicatrization was complete.

The experiment conducted by the University of Granada is the first to create artificial human skin with a dermis made of fibrin-agarose biomaterial. To this date, artificial skin substitutes were elaborated with other biomaterials as collagen, fibrin, polyglycolic acid, chitosan, etcetera.

These biomaterials "added resistance, firmness and elasticity to the skin" — according to Prof. Jiménez Rodríguez. "Definitively, we have created a more stable skin with similar functionality to normal human skin."

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