3D PRINTED CUSTOMISABLE VASCULAR SIMULATOR

DESCRIPTION OF THE TECHNOLOGY

Endovascular techniques fall within the context of minimally invasive surgical procedures, which consist of introducing catheters and other elements inside the patient's blood vessels to improve the treatment of certain vascular lesions. They are currently a rapidly developing medical field, allowing for more precise and less invasive diagnostic and therapeutic solutions to complex pathologies. However, the acquisition of skills and technical training in this field is difficult. Simulation with animal models is increasingly outdated and additive design is a promising alternative.

So far, the already known **vascular simulator** models are two-dimensional, i.e. they lack depth ratio. This allows for simplification of catheter handling but at the same time means loss of reliable correlation with real practice. Therefore, they are based on idealised and simplified theoretical anatomical models, not on real models.

In fact, the major disadvantage of the known models is that they do not allow to represent all the irregularities of the arterial walls, the differences in the internal calibre of the vessels and the anatomical tortuosity that in real interventions condition the vascular accesses and the stability of the catheters.

Therefore, The Design in Engineering and Technological Development (DIDET) group from the ArtefactosLAB laboratory, has developed a **modular system** that offers a simple but efficient solution to simulate vascular anatomical models of arterial networks customised for a patient, which accurately represent specific deformations or conditions. In this way, the tactile sensations of real clinical practice can be generated and interventions for different pathologies such as aneurysms or stenosis can be adequately trained.

The present invention makes it possible to reliably reproduce an arterial network from a real anatomical model, as well as to manufacture interchangeable sections that represent pathologies by replicating the lesions as they are. This enables more detailed preparation of real interventions to decide with greater certainty on the appropriate material and the best approach for each individual case.

The system consists of two parts: the base, which supports the arteries and gives stability to the system as a whole, and the arterial network, which simulates the real vascular anatomy and is attached directly to the supports of the base by pressure (see Figure 1).

In short, a customisable vascular simulator has been achieved to improve the medical training and surgical planning.

MARKET APPLICATION SECTORS

It is primarily aimed at the **healthcare technology and innovation sector** for the improvement of medical training and surgical planning. 3D printing or additive manufacturing is a technique that can be applied to meet any need in any sector.

TECHNICAL ADVANTAGES AND BUSINESS BENEFITS

- Versatility: The modular system can partially configure a part of the anatomy (head, leg, arm, etc.) or the entire human body by joining the different modules together.
- Quick assembly and disassembly of both the modules and the interchangeable sections.
- It allows complex clinical cases.
- The interchangeable sections are made of transparent and radiolucent material.
- **3D printing** offers great flexibility and customisation at a low cost.

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CURRENT STATE OF DEVELOPMENT

A **prototype** has been developed with the participation of different medical specialists who have tested and adjusted the dimensions and performance of the simulator (see Figure 2).

INTELLECTUAL PROPERTY RIGHTS

This technology is protected by **patent application.**

- Patent title: “Sistema modular de tramos intercambiables para simulación vascular y procedimiento de fabricación de los tramos intercambiables”.
- Application number: P202131127
- Application date: 03/12/2021

COLABORATION SOUGHT

From ArtefactosLAB, the DIDET group is looking for companies or institutions interested in supporting the development of the system or in the design and manufacture of other new devices for social or health purposes.

RELATED IMAGES

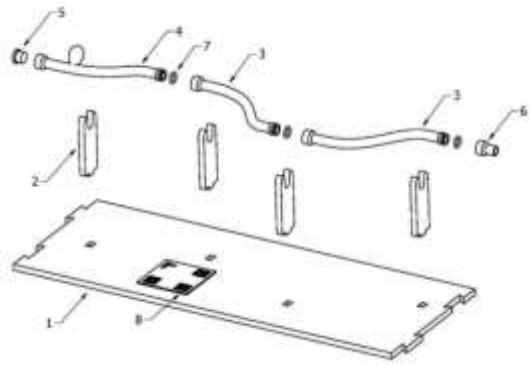

Figure 1: *Components of the modular system of interchangeable sections.*

Figure 2*: Detail view of the arterial network of the prototype.*

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