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Numerical Methodology to Support the Development of a Double Chamber Syringe

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Abstract : The process of flushing is considered to be an adequate technique to reduce the risk of infection during the clinical practice of venous catheterization. Nonetheless, there is still a lack of adhesion to this method, in part due to the complexity of this procedure. The project SeringaDuo aimed to develop an innovative double-chamber syringe for intravenous sequential administration of drugs and serums. This device served the purpose of improving the adherence to the practice, through the reduction of manipulations needed, which also improves patient safety, and though the promotion of flushing practice by health professionals, by simplifying this task. To assist on the development of this innovative syringe, a numerical methodology was developed and validated in order to predict the syringe's mechanical and flow behavior during the fluids' loading and administration phases, as well as to allow the material behavior evaluation during its production. For this, three commercial numerical simulation software was used, namely ABAQUS, ANSYS/FLUENT, and MOLDFLOW. This methodology aimed to evaluate the concepts feasibility and to optimize the geometries of the syringe's components, creating this way an iterative process for product development based on numerical simulations, validated by the production of prototypes. Through this methodology, it was possible to achieve a final design that fulfils all the characteristics and specifications defined. This iterative process based on numerical simulations is a powerful tool for product development that allows obtaining fast and accurate results without the strict need for prototypes. An iterative process can be implemented, consisting of consecutive constructions and evaluations of new concepts, to obtain an optimized solution, which fulfils all the predefined specifications and requirements.

Keywords : Venous catheterization, flushing, syringe, numerical simulation
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