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Abstract

Digital workflow for Additive Manufacturing of patient-specific implants

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A paradigm shift has taken place in medical care in recent years. Design limitations no longer exist; instead, implants are designed individually for each patient and produced by means of Additive Manufacturing (AM), often also referred to as 3D printing. As a result, a patient-specific implant design can be derived based on image of patient's unique anatomy and then manufactured additively [1]. The quality requirements are identical to those for conventionally manufactured implants and are subject to the requirements of the Medical Device Regulation (MDR) in the European Union (EU).

However, the individual processes, from design generation to additive manufacturing right through to the MDR-compliant implant, cannot be depicted coherently at present due to a variety of data interfaces. The implant quality varies with the expertise of the engineer and medical. [2] Planning complexity significantly determines the time until the actual care of the patient. In addition, there are only a few automated processes along the physical value chain that generate predictable and reproducible results. Quality parameters are difficult to derive, and manually executed processes are almost impossible to quantify.

As part of the DigiMed project, an end-to-end digital and physical value chain was established by combining digitization, Artificial Intelligence (AI), and AM in the development of customized imaging, design, and manufacturing strategies. The obtained results demonstrate that a reduction of cost and duration of the AM process can be achieved by 40% while increasing the implant quality and fit accuracy of the components by 30%. Furthermore, the results demonstrated that it is possible to minimize the length of hospital stay from 9 to 3 days and that a less painful therapy option is available for the patient due to the patient-specific treatment. The planning effort and time of the surgery could also be minimized for the medical staff.

AUTHOR'S STATEMENT

Authors state no conflict of interest.

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