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An exciting new era in additive manufacturing and 3D printing: medical and health-care applications

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The development of additive manufacturing (AM)/3D printing technology, with its unique capability of producing highly complex (customized) structures in relatively short times, has opened a broad range of possibilities in several fields of scientific and economic interest. A brunch, where the application of AM has attracted significant interest is that of health-care and medical products and services. During the past 20 years various AM technologies have been successfully applied in the production of medical models, prosthetics, dental correction and hearing aid devices, etc. In these areas AM technologies are gradually becoming the standard for manufacturing, through the development of more advanced and novel systems and materials. Furthermore, there is an ongoing and growing research interest and effort in the areas of tissue engineering, biofabrication and drug delivery devices, where AM has the potential to provide solutions to several existing problems as well as to create exciting new opportunities, such as those offered by bioprinting biocompatible, live and growing implantable tissues and organs. The purpose of the present paper is to provide a comprehensive summary of the multi-disciplinary and rapidly evolving field of medical applications for AM. In this context, several cases are presented and discussed. Particular emphasis is given to cardiovascular applications. These include building patient–specific models, which greatly facilitate surgical planning and optimal implantation of surgical or percutaneous devices, minimizing complications and related costs, and enhance surgical education via on-line access to 3D models of complex pathologies as well as by creating disease-specific surgical simulation factors.

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