

Additive Manufacturing (3D Printing): A New Approach for the Manufacture of Individualized Medicines

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Introduction

Additive Manufacturing or Three-dimensional printing (3DP) has been recently identified as an opportunity to make a significant technological leap over traditional pharmaceutical manufacturing processes, especially regarding individualization of medicines, and benefiting from the ongoing digital revolution within healthcare. 3DP presents remarkable advantages (but also limitations) to dosage forms manufacturing. Considering the state of the art in multiple perspectives, this work aims to envision the future of the design and manufacture of 3DP individualized medicines in the next decade, through a SWOT analysis.

Strengths

Design and development of individualized medicines with flexible and precise doses for patients with chronic diseases (e.g. multiple active substances, modulation of the drug release kinetics, different shapes easily identifiable by patients); Design *ab initio* of medicines for specific patient groups (e.g. paediatrics/geriatrics) or patients with specific problems (e.g. kidney/hepatic impairment); Design and manufacture of medicines for rare diseases (e.g. orphan drugs); Manufacture of medicines closer to patients (e.g. 3D printers are eligible for implementation in compounding pharmacies); Advantages of drug products manufactured compared to traditional industrial manufacture (e.g. scale up not required); Promotion of hospital and community pharmacists on prescription evaluation and patient counselling; Increased role of pharmacists on patient care; Overall promotion of pharmacists as service providers.

Weaknesses

Requirement of trained personnel and qualified

technical/technological resources; Initial investment on equipment and software in compounding pharmacies; Running costs may increase; Daily professional practice must change.

Opportunities

3DP re-centres compounding pharmacy, creating a huge value for this activity; Better articulation between manufacture and pharmaceutical advice; Enhanced closeness between pharmacists and patients throughout the process; Higher involvement of patients and patients' associations in medicines' usage; Larger benefits in compliance and health literacy.

Threats

Co-participation of the medical and pharmaceutical classes on handling prescriptions for 3DP medicines; Physicians and pharmacists must change daily practice because medicines are designed, manufactured and prescribed for patients in a different/tailored way; Stakeholders connected to medicines may resist to changes.

Conclusions

In conclusion, emergent 3DP can potentially contribute to better, patient driven medicines. Pharmaceutical sector and academia are, through research, paving the way to tailored and readily available medicines according to the patient's need, reinforcing the pharmacist role as a healthcare provider.

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