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Editorial

3D Bioprinting: Technology in Dentistry

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Hard tissues and organs, including the bones, teeth and cartilage, are the most extensively exploited and rapidly developed areas in regenerative medicine field. One prominent character of hard tissues and organs is that their extracellular matrices mineralize to withstand weight and pressure. Over the last two decades, a wide variety of 3D printing technologies have been adapted to hard tissue and organ engineering. 3D printing is also known as additive manufacturing (AM), rapid prototyping, layered manufacturing or solid free form fabrication [1,2]. Why 3D printing has taken off so greatly in the recent past? The dental profession has accepted the digital manufacturing technologies. Much of the laboratory work that was once produced by artisan processes is now produced digitally, leaving only the final finishes of restorations to be applied by hand.

The use of CAD CAM technology has become common in the dental laboratory. Whereas early approaches to scanning and the production of digitally manufactured restorations relied upon the use of centralized scanning and manufacturing facilities, many laboratories now have their own scanners, and many also have their own milling units. In the dental practice environment, intra oral and CBCT scanners are becoming more and more common.

Modern dentists and dental technicians are becoming well acquainted with large volumes of digital data. 3D printing offers a form of 'output' device for dental CAD software making it possible to materialize intricate components and objects in a variety of different materials [3]. Compared with traditional tissue engineering approaches, 3D printing technologies are often sophisticated, flexible, and automated [4-6]. Through the use of 3D printers, the manufacturing procedures can be dramatically simplified. Over the last decade, many industrial 3D printers have been employed to generate porous scaffolds for hard tissue engineering [7].

Whereas some distinctive 3D printers for cell-laden tissue and organ manufacturing have drastically increased [4-6]. The main advantage of 3D printing technologies in large hard tissue and organ engineering is their capability to produce complex 3D objects rapidly from a computer model with varying internal and external structures, such as go-through channels. These complex 3D objects can be either tissue engineering porous scaffolds, cell/biomaterial composites, homogeneous tissues, or multiple tissue contained organs [8,9].

The technology is already widely used in orthodontics, where high-resolution printing in resin is already an entirely practical proposition, and similar technology is being used to print models for restorative dentistry and patterns for the lost wax process which is becoming increasingly important with the rise of intra-oral scanning systems. In maxillofacial and implant surgery, it is becoming commonplace and prerequisite to use anatomical models made by any number of different 3D printing techniques to assist with the planning of complex treatments. It is widely acknowledged that surgery may be less invasive and more predictable with the use of surgical guides printed in resins (commonly) or autoclavable nylon. For many, the real excitement will be in the direct production of metal-based restorations for implants and teeth [3].

Although 3D printers are becoming more affordable, the cost of running, materials, maintenance, and the need for skilled operators must be carefully considered, along with the need for post-processing and adherence to strict health and safety protocols. Despite these concerns it is clear that 3D printing will have an increasingly important role to play in dentistry.

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