EDITORIAL

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The application of three-dimensional printing techniques in the field of oral and maxillofacial surgery

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Recent advancements in science and technology have resulted in important changes in the medical field. Three-dimensional (3D) printing is a good example of such developments and has already achieved a considerable level of technical development in many industrial fields.

Use of this innovative manufacturing technique is gradually expanding in the medical field. In clinics, application of 3D printing can be largely divided into diagnostic or treatment purposes. Meanwhile, research in the basic sciences is also advancing, allowing 3D printing of tissue or organs via cell bioprintings. This technology could potentially change the paradigm of the medical community[1].

Because of its usefulness, various applications of 3D printing should be considered in the area of oral and maxillofacial surgery. In fact, the field of oral and maxillofacial surgery has sought to apply a simple rudimentary form of 3D printing technique for a long time. Use of 3D-printed rapid prototyped models before oral cancer surgery or orthognathic surgery for treatment planning and simulation has been established to assure more precise and safe surgeries[2]. Moreover, surgical stents are fabricated using computed tomography (CT) images in the field of dental implantology[3]. It is necessary to move forward and adopt this technology in the fabrication of complex forms of molds in order to provide individualized medical services. For example, easier production of customized and reconstruction plates and morphologic reconstruction of bony defect areas are possible uses of 3D printing in fracture surgery or reconstructive surgery. The 3D printing technique can also be utilized in other areas of oral and maxillofacial surgery. For example, it would be very helpful to be able to design and fabricate a customized non-absorbable barrier of titanium mesh.

In addition, 3D printing could be used in other fields of dentistry. For example, individual occlusion could be accurately determined and treated with a unique splint fabricated using 3D printing. It would be beneficial for patients if splints could be fabricated without the need for cast impressions. Orthodontic appliances also could be manufactured with 3D printing. Considering a wide variety of morphologies of the tooth surfaces, appliances with customized surfaces would be helpful[4].

Of course, there are still problems with 3D printing that need to be solved, such as the high cost; that this technology is not yet cost-effective. However, though it is difficult to justify the use of 3D printing on general surgery patients, the use of 3D printing might be much more appropriate for patients with special needs. For example, it is possible to greatly reduce the operation time if highly customized devices are prepared in advance, since it would exempt the time-consuming process of bending or modifying the appliance during the surgery. This would ultimately benefit the patient. Increased precision of the technique will also result in a wider range of applications for 3D printing. In addition, increased resolution in medical imaging such as CT will allow greater use of 3D printing[5]. Material science and engineering are also important areas in which 3D printing will be useful. Materials that are relatively easy to modify, such as polymers or plastics, are already at a high level of technological development, though materials such as metals, alloys, or other composites are still under development[6].

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Many countries are increasing their national policies that support the developing 3D technology. In order to respond to the demands and remain competitive, oral and maxillofacial surgeons should have an interest in 3D printing and understand its various applications. Though it is important to have the source technology, its utilization in a variety of fields should not be overlooked. In target business models such as jewelry/accessory and interior, customized device/healthcare structure, early participation of the potential customer is also being encouraged. Moreover, since complex mold forms can be more readily manufactured using 3D printing, mass production is a future goal in applicable fields.

In conclusion, the role of 3D printing in oral and maxillofacial surgery should be a focus of interest since the technique could offer endless developmental possibilities.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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