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Opinion

3-D Print of Bone Replacement, from 3-D to 4-D Technology

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Abstract

Bone replacement will be a reality by modern printing techniques in the future. To promote its development and clinical applications, many new technologies will be built. This editorial discusses this hot topic.

Keywords: *Bone Replacement; 3-D Printing; Biomaterials; Modern Technique*

Introduction

Human bone is one of the most vulnerable tissues in human bodies. In the life-time of most people, bone fracture, osteoporosis, pain symptoms, cancer and metastasis are frequently met [1-9]. Bone-induced human disable is one of the leading causes for morbidity and mortality.

Modern development

Bone disease commonly needs complicated surgery, long terms of physiological recovery or replacement [10,11]. Among these modern technology, 3-D prints is a promising trend in the clinic [12-14].

Presently, a systematic approach has been made for replacing broken bones with artificial bones. This process may treat a lot of patients in the future (Figure 1).

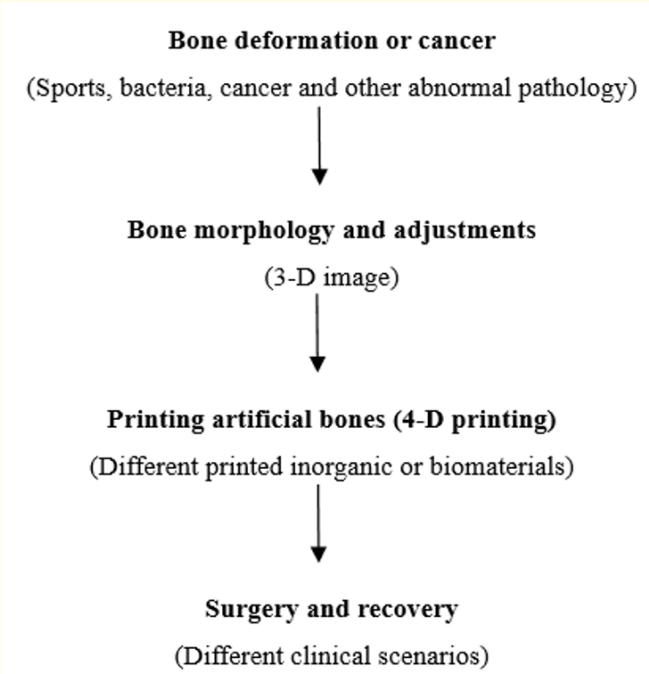

Figure 1: *Outlook of 4-D-print bone treatments.*

Discussion

Patients with bone diseases are greatly different in biomaterials. The artificial bone producers may be difficult to provide all these different products. As a result, the content of different biomaterials (4-D printing technology) may determine different treatment outcomes. It needs new investigations and technologies.

Future Trends

In the future, image-based 3-D printers will be used to print artificial bones to replace broken or dead bones. From these efforts, a great difference will be made (from 3-D printing to 4-D printing). In these active areas, math-modality and pharmacology study may be helpful [15,16]. The biomaterials in the printers can have different therapeutic outcomes and bone regeneration.

Conclusion

With the quick developments of 4-D printers, all human bone tissues and joints may be available in a lot of hospitals. This is a great future challenge.

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