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Treatment of large bone defects in load-bearing bone: traditional and novel bone grafts

Key words: Bone graft; Bone scaffold; Biomaterial; Load-bearing bone defect; Osseointegration; Osteoconductivity

Research Summary

In this review, we aim to guide readers towards a thorough understanding of the development of bone grafts for load-bearing bone defects from a fresh perspective, rather than solely focusing on the classification of grafting materials. We will present the traditional and novel bone grafts available for load-bearing bone defects and focus on recent design strategies for promoting bone regeneration based on substance, structural, and functional bionics.

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Innovation points

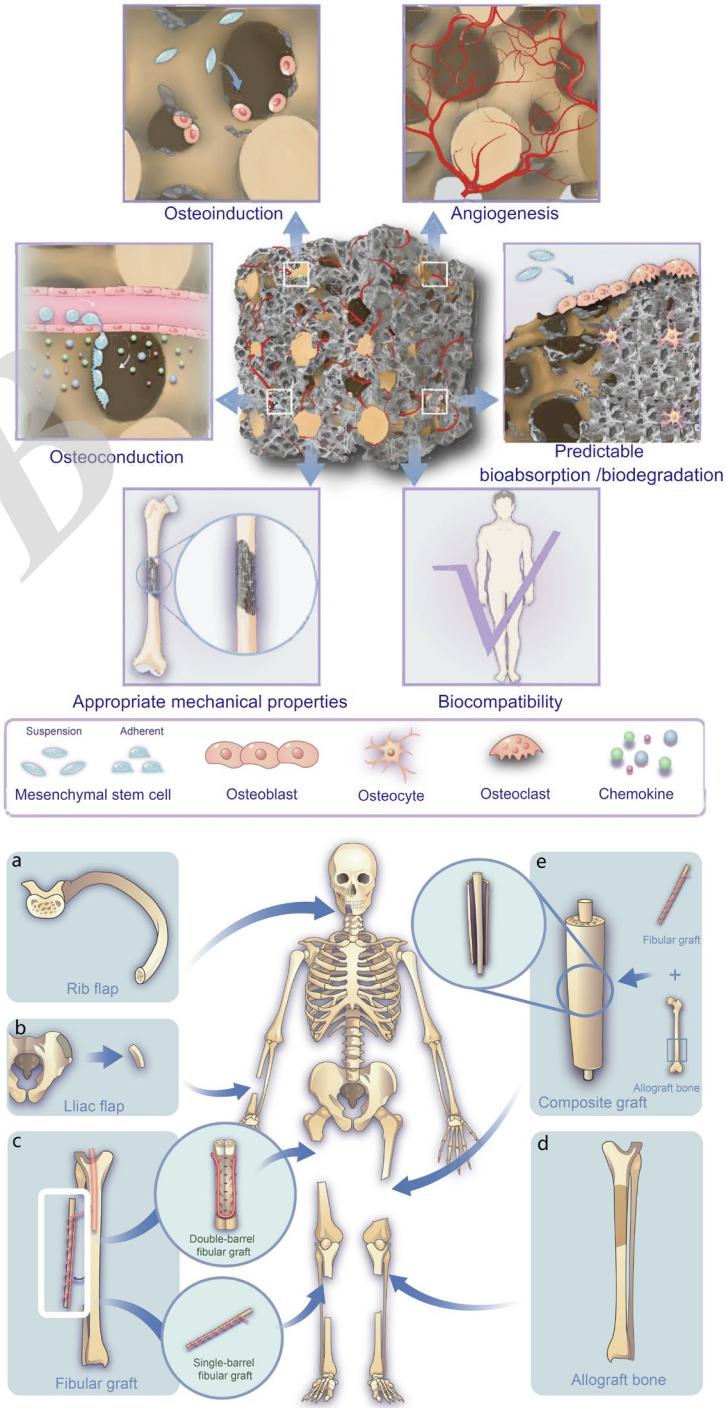
- **Introduction of the natural bone biology, bone defect healing process, and ideal properties of bone grafting materials.**

Ideally, bone grafting materials should satisfy the following requirements:

- osteoconductivity
- osteoinductivity
- biocompatibility
- angiogenesis
- mechanical properties matching natural bone
- controlled bioabsorption/biodegradation

- **Summary of traditional bone grafting materials for repairing critical-size bone defects in load-bearing bone.**

- Autografts
- Allografts



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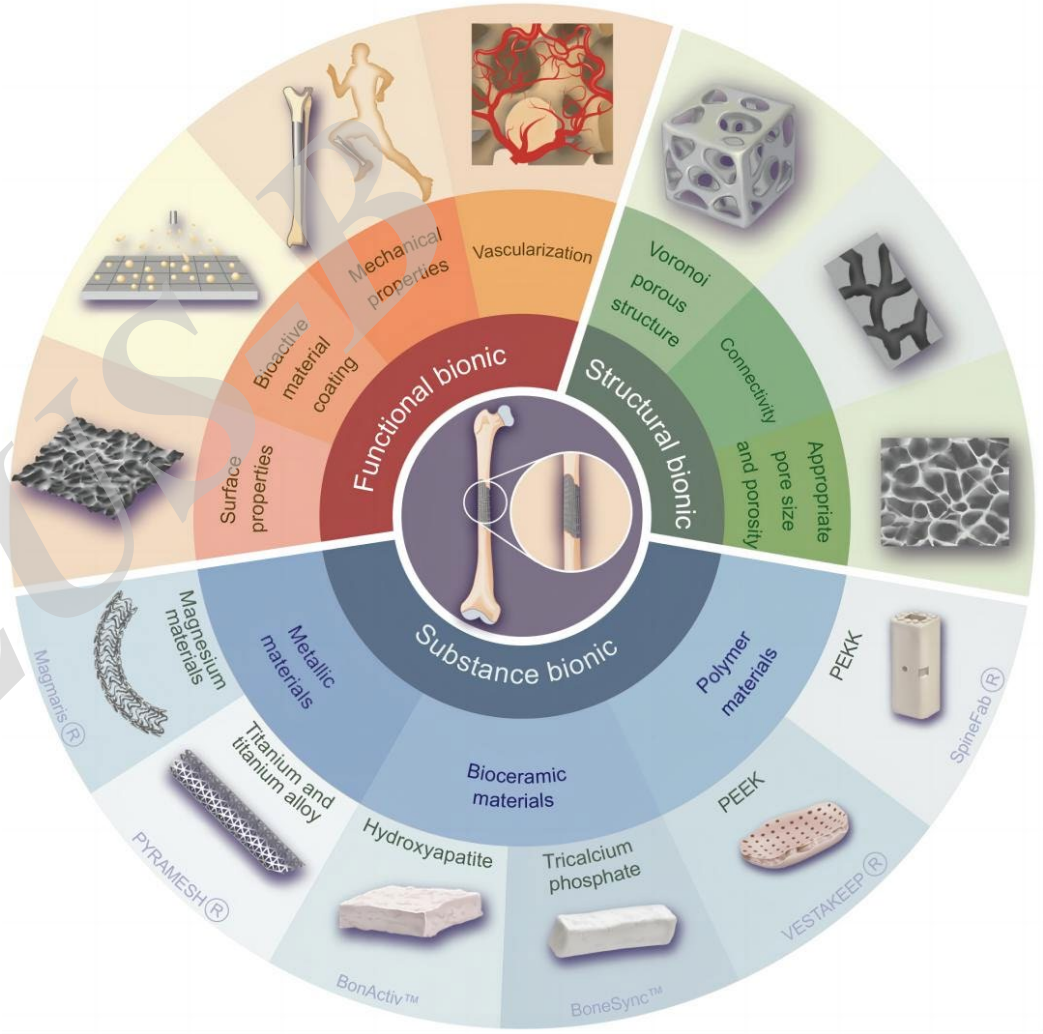
Innovation points

- **Emphasis on recent development strategies for novel bone grafts appropriate for load-bearing bone defects based on substance, structural, and functional bionics.**

Development strategy based on substance bionics:
- **Metallic bone grafting materials**
- **Bioceramic bone grafting materials**
- **Polymer bone grafting materials**

Development strategy based on structural bionics:
- **Pore Architecture**
- **Irregular Porous Structure**
- **Fabrication of Bone Grafts with Bionic Structure**

Development strategy based on functional bionics:
- **Surface Properties of Bone Grafts**
- **Mechanical Loading and Mechanical Stimulation Transmitting of Bone Grafts**
- **Vascularization and Innervation of Bone Grafts**
- **Approaches to Simulation of Endochondral ossification**



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