Paradigm Shift in Advanced Bone Graft Materials Aligned with Dental Surgical Innovations

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Purpose
Bone graft materials have undergone significant evolution, moving from autografts and allografts to xenografts and synthetic alternatives. The purpose of this presentation is to review this progression, with a particular focus on addressing the limitations of existing materials—such as infection risk and limited supply—and highlighting the development of advanced synthetic bone grafts that align with modern dental surgical needs.
Methods
Calcium phosphate (CaP)-based materials have been central to this progress due to their chemical resemblance to natural bone. Early materials such as hydroxyapatite (HA) demonstrated excellent biocompatibility and osteoconductivity. Later advancements introduced biphasic calcium phosphate (BCP), combining HA with β-tricalcium phosphate (β-TCP) for improved resorption and regenerative potential. Recent developments in materials science, nanotechnology, 3D bioprinting, and calcium phosphate cements (CPC) have further enhanced graft performance and clinical versatility.
Results
Among these advancements, octacalcium phosphate (OCP) has gained significant attention for its close resemblance to natural bone formation processes. OCP supports rapid bone regeneration. Studies have shown that OCP-based materials can achieve bone formation levels comparable to allografts, with the added benefits of controlled degradation and stable host tissue integration. Clinical and preclinical data further demonstrate improved cell activity, angiogenesis, and consistent bone growth.
Conclusion
In conclusion, OCP-based synthetic bone grafts represent a paradigm shift by delivering a balance of efficacy, safety, and versatility. These materials show great promise as next-generation bone graft substitutes, particularly for advanced dental surgical applications where predictable outcomes and material handling properties are critical.

Profile
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