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Advancements in Brushite cement formulations for bone repair

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STELLINGEN

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Advancements in Brushite cement formulations for bone repair.

1. Delaying brushite cement hardening by incorporating polymeric setting retarders can extend the initial setting time from 30–60 s to 4–7 min—meeting the 3–8 min clinical window without sacrificing bioactivity (this thesis).
2. Adding type I collagen to brushite formulations increases compressive strength from 0.8 MPa up to 1.7 MPa, enabling potential use in low load bearing orthopedic applications (this thesis).
3. Incorporation of sodium alginate in tetracycline-loaded cements improves injectability to as much as 50%, facilitating minimally-invasive defect filling (this thesis).
4. Combining α -TCP and silk fibroin with brushite cements prolongs final setting times up to 30 min while maintaining porosity between 39.6 % and 49.9 %, balancing handling and scaffold interconnectivity (this thesis).
5. The dissolution–precipitation setting mechanism of brushite cements underpins reproducible crystal growth, making phase formation highly tunable by pH and composition adjustments.
6. Polymeric reinforcement strategies, such as collagen integration, offer a generalizable route to enhance mechanical properties across calcium-phosphate cement systems.
7. Drug release from brushite matrices follows a diffusion-controlled profile in the first eight hours, enabling predictable local dosing in bone-infection therapy.
8. Injectable brushite cements combine rapid in situ hardening with conformal defect filling, representing a scalable alternative to prefabricated scaffold approaches.
9. Localized antibiotic delivery via brushite cements can reduce systemic antibiotic administration, contributing to efforts against antibiotic resistance.
10. Rapid resorption of brushite promotes faster bone remodeling and may shorten patient recovery times and healthcare costs compared to more stable apatite cements.