

Kharkiv National
Medical University

INTERNATIONAL SCIENTIFIC INTERDISCIPLINARY CONFERENCE

of Young Scientists and Medical Students

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25-27

May

2026

Kharkiv, Ukraine



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heals and
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Panenko Michelle

PHARMACO-GENETIC REPLACEMENT OF ODONTOGENESIS
TREATMENT STRATEGIES: COMPARATIVE EFFICACY OF DE-NOVO
INDUCERS OF MAXILLOFACIAL REGENERATION

Kharkiv National Medical University

Department of Pharmacology and Medical prescription

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Tooth loss caused by caries, periodontitis, and congenital anomalies remains a major clinical challenge, as conventional prosthetics fail to restore the biological integrity of the dentoalveolar system. This necessitates the development of novel strategies, including pharmaco-genetic induction of de novo odontogenesis. A key molecular target is USAG-1 (*Sostdc1*), a dual antagonist of BMP and Wnt signaling that maintains odontogenic programs in a suppressed state after embryogenesis. Its pharmacological inhibition can reactivate regenerative potential in adult dental tissues. The aim of this study was to perform a comparative pharmacodynamic and pharmacokinetic analysis of three approaches to odontogenesis induction: antiUSAG-1 monoclonal antibodies, GSK-3 β inhibitors, and recombinant proteins (BMP-7, Wnt3a).

A comparative multi-criteria analysis was performed based on predefined data extracted from selected peer-reviewed publications, including preclinical studies and review articles focused on pharmacological stimulation of odontogenesis. The analysis was conducted using predefined pharmacodynamic and pharmacokinetic parameters, including efficacy of odontogenesis induction, safety, pharmacokinetic profile, and clinical translatability.

Anti-USAG-1 monoclonal antibodies demonstrated the highest regenerative efficacy by activating BMP/Wnt signaling and inducing Smad1/5/8 phosphorylation. In vivo, they stimulated the formation of structurally complete teeth in 30–40% of cases. Their prolonged half-life (14–21 days) ensures stable target inhibition without systemic toxicity; clinical trials are ongoing.

GSK-3 β inhibitors (tideglusib, NP928, LiCl) act via β -catenin stabilization and activation of Wnt-dependent transcription, promoting odontoblast differentiation and reparative dentinogenesis. Their main advantage is local delivery with minimal systemic exposure. Nanoencapsulation enables controlled release (18–48 h) and improves bioavailability. Recombinant proteins (BMP-7, Wnt3a) directly activate

signaling pathways but are limited by rapid degradation and short half-life. Their efficacy increases in sustained-release systems, although safety concerns remain. The conducted analysis demonstrates that anti-USAG-1 antibodies provide the highest efficacy and pharmacokinetic stability, GSK-3 β inhibitors offer the best balance between effectiveness and clinical applicability, while recombinant proteins remain limited by pharmacokinetic constraints. A combined strategy targeting USAG-1 with adjunct local delivery of GSK-3 β inhibitors may represent the most promising direction for controlled odontogenesis induction.