LETTER TO THE EDITOR

About the articles in Issue 2

A Generalized Analytical Review of Articles in a Issue 2 on advanced technologies in modern stomatology

Introduction

Modern stomatology is undergoing a period of intense transformation driven by the integration of digital technologies, molecular biology, nanomedicine, and regenerative approaches. Traditional clinical protocols, based primarily on empirical experience and standard treatment algorithms, are gradually giving way to personalized and biologically oriented strategies. The nine research articles presented in this special issue reflect key areas of this transformation, including artificial intelligence (AI), gene and mRNA therapy, tissue bioengineering, nanotechnology, and clinical prevention. Taken together, these studies form a scientific platform aimed at moving from symptomatic treatment to biologically controlled restoration of oral and maxillofacial structures.

Artificial intelligence as the basis for a new clinical paradigm

The article by ***Das A.C. et al.*** "Artificial intelligence in therapeutic decision-making for complex dental diseases: a review", forms the conceptual basis for the entire issue, demonstrating that AI in stomatology has evolved from a diagnostic tool to a full-fledged participant in therapeutic decision-making. The use of machine learning algorithms and deep neural networks allows us to predict treatment outcomes, model orthodontic movements, optimize implantation, and design prosthetic structures. Particularly important is the transition to a *human in the loop* concept, in which AI does not replace the doctor, but rather enhances their analytical capabilities, minimizing errors and variability between operators. This reflects the modern philosophy of medical automation, which is aimed at supporting clinical thinking rather than replacing it.

Personalized therapy and controlled drug delivery

The article by ***Tuenkar Y.A. et al.*** "Ai-**guided personalized drug-delivery nanoparticles for precision treatment of peri-implantitis: a multicenter evaluation**", demonstrates the practical implementation of the concept of AI-guided personalized therapy in the treatment of peri-implantitis. The use of algorithms for the analysis of biomarkers (IL-1β, MMP-8) and microbial profiles made it possible to adapt the kinetics of minocycline release from nanoparticles to individual patient characteristics. Clinical results—significant reduction in periodontal pocket depth, reduced bleeding, and bone growth—confirm the effectiveness of integrating AI and nanotechnology. This study effectively demonstrates the transition of stomatology to a "precision dentistry" model similar to precision medicine in oncology and cardiology.

Nanotechnology as a biological interface

Several studies in the issue are devoted to the functionalization of stomatology materials using nanoparticles. The article by ***Alfawzan A.A. et al.*** "**In-vitro evaluation of nanoparticle-reinforced orthodontic adhesives for enhanced shear bond strength and antimicrobial activity**", shows that hybrid nanocomposites (TiO_2 + Ag) provide significant antibacterial activity against *Streptococcus mutans* while maintaining the mechanical strength of orthodontic adhesives. This is particularly important in the context of preventing demineralization and white spots during orthodontic treatment, where biofilm remains a key pathogenetic factor. Thus, new generation materials become not passive fixators, but active biomodulators.

Nanobioimmunotherapy of oral cavity tumors

The work by ***George A.L. et al.*** **"CAR-T–inspired immunomodulatory nanovesicles for targeted elimination of oral squamous cell carcinoma cells",** represents a fundamentally new platform for the treatment of oral squamous cell carcinoma. The use of CAR-T-like nanovesicles allows preserving the specificity and cytotoxicity of immune cells while simultaneously eliminating their systemic toxicity. Selective destruction of EGFR-positive tumor cells with minimal impact on normal fibroblasts opens the way to the creation of "off the shelf" immune drugs for oncostomatology,

which is a revolutionary step for clinical practice.

Gene and mRNA therapy in regenerative stomatology

The articles of ***Alam M.K. et al***. **"Laboratory assessment of crispr-mediated modulation of osteoblastic and osteoclastic gene expression under simulated orthodontic force"** and ***Jalaluddin M. et al.*** "**MRNA-based regeneration of periodontal ligament fibroblasts: a translational pilot study**", demonstrates two complementary molecular approaches to tissue regeneration. CRISPR modulation of RANKL enhances osteoclastic activity, allowing for control of the rate of orthodontic tooth movement, a process previously thought to be biologically fixed. mRNA-FGF2, on the contrary, stimulates the proliferation and migration of periodontal ligament fibroblasts, providing a sustainable regenerative effect due to endogenous protein synthesis. This eliminates the key limitations of recombinant growth factors: instability and short half-life.

Pulp regeneration and tissue engineering

The article of ***Jadhav S. et al.*** "**Stem-cell–derived bioengineered dental pulp constructs for vital pulp therapy: a randomized laboratory trial**", takes vital pulp therapy beyond "preservation" and introduces the concept of true regeneration. Constructs based on stem cells and GelMA hydrogel demonstrate not only the formation of dentin-like tissue, but also pronounced angiogenesis, which is necessary for the restoration of the neurovascular complex. This opens the way to biological restoration of the pulp, rather than its isolation under biocements.

Clinical research and prevention

The study by ***SadatMansouri S. et al.*** "**Cyanoacrylate vs. dentin bonding on reducing dental sensitivity**", confirms the clinical significance of simple but biologically based interventions: cyanoacrylates provide rapid and stable reduction in hypersensitivity by sealing dentinal tubules. Both modalities demonstrated a significant reduction in sensitivity within 24 hours after application, with the effect remaining stable after one week.

The study by ***Azatyan V.Yu. et al.*** "**Evaluating the effects of cigarette smoking and heated tobacco products on the oral mucosa and periodontium in patients with hepatit C virus in Armenia: a pilot study"**, expands dentistry into systems medicine, demonstrating that smoking in patients with HCV significantly increases microbial aggression and periodontal inflammation, while heated tobacco products have a less destructive effect. These findings suggest that while tobacco use remains a risk factor, heated tobacco products may be associated with less severe oral manifestations in hepatitis C virus patients. Further studies with larger samples are required to confirm these observations and clarify long-term effects.

Conclusion: The articles presented in this issue provide a comprehensive scientific picture of the future of stomatology—a discipline based on data, biology, and personalization. AI, genomic technologies, nanomaterials, and stem cells are becoming not an add-on, but the foundation of clinical practice. This issue of the journal demonstrates the transition from mechanistic treatment to biologically controlled, intelligent and regenerative dentistry, defining the vector of development of science and practice for the coming decades.

The joint publication of similar articles provides stomatologists from various fields with an excellent opportunity to gain a comprehensive understanding of modern approaches to stomatology and the latest treatment methods, which can serve as a basis for their practical activities aimed at improving the quality of life of the population.

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Vahe Yu. Azatyan MD, PhD, DSc
Professor
Department of Therapeutic Stomatology
Yerevan State Medical University named after M. Heratsi
Scientific and Educational Center of Stomatology, Yerevan State Medical University named after M. Heratsi, Yerevan, Armenia