TABLE 3. Selected regenerative modalities of major regenerative modalities in oral and maxillofacial surgery.

Regenerative modality	Principal therapeutic rationale	Human clinical evidence	Main clinical signal	Key evidence limitation	Translational maturity	Current clinical position
Mesenchymal stromal/stem cells (MSCs)	Cell-based osteogenic, angiogenic and immunomodulatory regeneration, generally combined with grafts or scaffolds [1,3,4,6]	Clinical studies and systematic reviews across selected OMFS indications [7,15,16,17,20,21]	Clinical feasibility and potential improvement in bone and periodontal regeneration in selected indications	Small and heterogeneous trials; variable cell sources, processing methods, scaffolds, dosing and outcome measures; limited evidence of superiority over standard treatment [1,7,15,16,21]	Early clinical translation	Investigational adjunct; not established as a routine replacement for conventional grafting
Platelet-rich plasma (PRP)	Autologous delivery of platelets and growth factors to support healing and tissue regeneration	Clinical evidence from platelet-concentrate literature	Potential benefit in selected healing and regenerative applications	Substantial variation in platelet concentration, leukocyte content, activation and preparation protocols; inconsistent hard-tissue outcomes	Clinically integrated in selected applications	Adjunctive modality; indication-specific
Platelet-rich fibrin (PRF)	Autologous fibrin-based matrix providing platelets, leukocytes and growth factors within a three-dimensional scaffold [8,9,11,12]	Multiple clinical studies, systematic reviews and recent meta-analyses [10,13,14,18,19]	Clinical signal for improved soft-tissue healing and selected postoperative, periodontal and ridge-preservation outcomes	Protocol heterogeneity and variable clinical endpoints; evidence does not support predictable substitution for grafting [18,19]	Clinically integrated	Clinically integrated adjunct in selected oral and maxillofacial procedures
Concentrated growth factor (CGF)	Autologous platelet concentrate with a dense fibrin network and concentrated growth factors [22]	Mainly biological and limited clinical evidence	Potential regenerative and healing effects in oral and maxillofacial applications	Limited high-level comparative evidence; heterogeneous preparation protocols; insufficient long-term clinical data	Early clinical translation	Emerging adjunctive modality
Bone marrow aspirate concentrate (BMAC)	Delivery of autologous marrow-derived cellular and trophic components to support bone regeneration	Limited modality-specific evidence within the present reference set	Biological rationale and potential role as a cell-enriched adjunct to graft-based reconstruction	Insufficient modality-specific clinical evidence to establish efficacy or comparative superiority	Investigational	Experimental / investigational adjunct
MSC secretome / conditioned medium	Cell-free delivery of soluble paracrine factors with regenerative and immunomodulatory activity [23]	Predominantly preclinical and translational evidence	Strong biological rationale and regenerative potential without direct transplantation of viable cells	Variable secretome composition; lack of standardised production, dosing, potency assessment and clinical validation [23]	Investigational	Experimental; not established for routine surgical use
Extracellular vesicles (EVs) / exosome-based approaches	Cell-free delivery of proteins, lipids and nucleic acids mediating paracrine regenerative effects [24]	Predominantly preclinical evidence	Promising biological potential for tissue repair and regeneration	Major challenges in isolation, characterisation, dose definition, potency testing, standardisation and clinical translation [24]	Investigational	Experimental; not established for routine clinical use

Abbreviations: MSC = mesenchymal stromal cell; PRP = platelet-rich plasma; PRF = platelet-rich fibrin; CGF = concentrated growth factor; BMAC = bone marrow aspirate concentrate; EVs = extracellular vesicles.