

BIOENGINEERING AND MEDICAL-SURGICAL SCIENCES

UNITO - Harnessing the orally-derived stem cell potential for a biologically-oriented on-site targeted approach (BOOST) in periodontal regeneration

Funded By	UNIVERSITA' DEGLI STUDI DI TORINO [P.iva/CF:02099550010]
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Context of the research activity	Periodontal regeneration is the most desirable clinical outcome in the management of intraosseous and furcation periodontal defects. The aim is the complete restoration of the lost periodontal anatomy, i.e. the formation of new cementum, periodontal ligament (PDL) and alveolar proper bone. However, surgical techniques and biomaterials currently used limited the efficacy of periodontal regeneration. Cell therapy using autologous mesenchymal stem cells from the oral cavity may emerge as a solution to restore the architecture of the original periodontium due to their plasticity and ability to differentiate into osteo/cementoblast and periodontal ligament cell lines. However, a thorough characterization of these cell populations is lacking, especially in patients affected by periodontitis, as well as understanding the impact of inflammatory-driven senescence and epigenetic aging on their regeneration potential.
Objectives	The main aim of the research is centered on different specific objectives (SO): • SO1: To investigate the phenotypic characteristics and multi-differentiating capabilities of periodontal ligament derived stem cells (PDLSCs) from both periodontally healthy (hPDLSCs) and periodontitis patients (pPDLSCs), comparing them with dental pulp stem cells (DPSCs) from the same tooth. • SO2: To assess the stemness and senescence characteristics of hPDLSCs and pPDLSCs, based on the single or double expression of stemness and/or senescent markers. • SO3: To investigate the regenerative potential of the granulation tissue residing in severe periodontal defects for future translatable purposes. Specifically, to isolate and characterize mesenchymal stem cell populations from the granulation tissue, studying their differentiation capabilities and their secretome. • SO4: To explore a new method to modulate the stemness/senescence status of orally derived stem cells through senolytic and epigenetic regulator drugs, both in vitro and in animal model.

- SO5: To preliminary evaluate the clinical use of the stem cell populations from the oral cavity (including the palatal mucosa) by a chair-side dissociation device for periodontal tissue healing and regeneration.
- SO6: To explore novel bioengineered compatible materials in combination with MSCs to support biomechanical stability in non-containing periodontal and osseous defects.

Skills and competencies for the development of the activity

The candidate is expected to be graduated in Biology with competence in cellular and molecular biology.
The ideal candidate should have previous experience in cell biology, with at least one year of experience in:

- 1) in vitro cultures of bone, periodontal and dental pulp stem cells;
- 2) tubuligenic and angiogenic assays;
- 3) using flow cytometer to analyze cell immunophenotype;
- 4) materials available to mimic the bone tissue and knowledge of methods to test their biocompatibility, with particular emphasis at 3D printing (es. Polycaprolactone, etc)
- 5) gene expression and microCT analyses.

Conference/workshop participation related the topic of this fellowship represent a plus, as well as the knowledge of scientific English.