Human Tooth Organoids as a Tool to Study Amelogenesis

Objectives: Dental health is of utmost importance for our body's general health and well-being. However, nearly 90% of adults suffer from tooth decay. Current dental restorations are made of synthetic materials despite having only suboptimal results. Therefore, damaged or missing teeth are a major health problem. It would be advantageous if dental rehabilitation could be accomplished using biological material, preferably of autologous origin. Regenerating enamel from human biological material is one of the holy grails in regenerative and reparative dentistry.
Methods: Our research group recently succeeded in generating epithelial tooth organoids (ETO), starting from the dental follicle's epithelial cell rests of Malassez of extracted human wisdom teeth. Organoids are state-of-the-art structures derived from epithelial cells, mimicking an organ's composition, function, and architecture. Importantly, these ETO are able to unfold an ameloblast differentiation process. Therefore, these 3D structures could be used as a starting point to study the etiology and causes of enamel-related pathologies such as Molar incisor hypomineralization (MIH)'.
Results: In the first part of the project, a dual promotor-reporter system will be developed, enabling us to follow real-time ameloblast differentiation and subsequent enamel formation *in vitro*. Consequently, various ameloblast differentiation protocols, such as the addition of transforming growth factor beta (TGF-β), can be further compared and optimized. Next, during differentiation, organoids are subjected to various factors correlated with MIH, such as dioxin 2,3,7,8-tetrachlorodibenzo-para-dioxin (TCDD), the antibiotic amoxicillin, and elevated culture temperatures mimicking fever. Lastly, to search for genetic causes of MIH, which are presently unclear, we will make organoids derived from MIH patients and compare them with those obtained from healthy adults.
Conclusions: This research project will contribute to a broader understanding of MIH pathophysiology and to the further development of a reliable *in vitro* model for enamel regeneration, which can be used for cell-based dental tissue regeneration strategies in the long term.

Division:
Meeting: 2023 IADR/LAR General Session with WCPD
Location:
Year: 2023
Final Presentation ID: 1124
Abstract Category|Abstract Category(s): Stem Cell Biology

Authors
- **Hasevoets, Steffie** (UHasselt , Diepenbeek , Belgium)
- Hermans, Florian (UHasselt , Diepenbeek , Belgium)
- Vankelecom, Hugo (KULeuven , Leuven , Belgium)
- Declercq, Heidi (KULeuven , Kortrijk , Belgium)
- Lambrichts, Ivo (UHasselt , Diepenbeek , Belgium)
- Bronckaers, Annelies (UHasselt , Diepenbeek , Belgium)

Financial Interest Disclosure: NONE

SESSION INFORMATION
Interactive Talk Session
Stem Cell Biology: Dental Epithelium in Tooth Development, Enamel Formation and Stem Cells in Bone Formation
Saturday, 06/24/2023 , 11:00AM - 12:30PM