

## Human Tooth Culture: A Study Model for Reparative Dentinogenesis and Direct Pulp Capping Materials Biocompatibility

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### Organisation

**Name of the organisation** Katholieke Universiteit Leuven (KUL)

**Department** Oral Health Sciences

**Specific Research Group or Service** BIOMAT

**Country** Belgium

**Geographical Area** Flemish Region

### Partners and collaborations

Aix-Marseille University

## SCOPE OF THE METHOD

<b>The Method relates to</b>	Human health
<b>The Method is situated in</b>	Basic Research, Translational - Applied Research
<b>Type of method</b>	In vitro - Ex vivo
<b>Specify the type of cells/tissues/organs</b>	Human teeth

## DESCRIPTION

### Method keywords

Tooth Model

Ex-vivo Tooth Model

Human ex-vivo Tooth Model

Tooth Culture Model

### Scientific area keywords

Pulp Biology

Tooth regeneration

Dental Mineralization

Dental Repair

Tooth Repair

Reparative Dentinogenesis

### Method description

The objective of this *ex-vivo* model is to study the initial pulp-tissue reaction of the human pulp tissue to different pulp-capping materials.

**Methodology:** Freshly-extracted (mainly due to orthodontic reasons) healthy human teeth (impacted third molars) from young individuals (15-20 years old) are immediately collected, placed in 15-ml falcon tubes containing 5 ml of DMEM supplemented with 10% FBS, 1% penicillin/streptomycin and 1% fungizone and brought to the cell-culture laminar flow cabinet (within 4 hours). The teeth are cleaned with sterile tweezers and sterile blades and disinfected with 70% ethanol and sterile PBS. A class-I cavity (approx. 4x4x4 mm) is cut using a sterile bur at high speed under copious irrigation with sterile saline. The pulp tissue is exposed with a round carbide bur at low speed with abundant irrigation. Afterwards, the cavity is cleaned with sterile saline, gently dried with sterile cotton pellets and the selected materials are applied into the cavity. The cavity is further restored with glass-ionomer cement and a flowable composite is applied on the occlusal surface, in which a sterilized stainless steel orthodontic wire is seated, followed by 40-sec light-curing of the flowable composite using a light-curing unit with a light output of 1200 mW/cm<sup>2</sup>. The teeth is immediately hanged using the wire in separate wells of 24-well culture plates, each containing 1.5 ml of tooth-culture medium to ensure generous exposure of the pulp tissue to the medium. The medium is refreshed every day and the teeth are kept inside an incubator at 37°C / 5% CO<sub>2</sub> / 95% humidity for 4 weeks. Afterwards, the wire is removed and the teeth are immediately placed in 4% paraformaldehyde for two weeks to properly fix the tissue.

### **Lab equipment**

Biosafety cabinet flow hood ;

Incubator with 5% CO<sub>2</sub> and 95% humidity ;

Dental equipment: portable motor unit with high-speed and low-speed hand pieces and dental burs and sterile irrigation ;

Equipment for histology: Microtome, blades, glass slides, staining equipment and light microscope.

### **Method status**

History of use

Internally validated

Published in peer reviewed journal

## **PROS, CONS & FUTURE POTENTIAL**

### **Advantages**

Little ethical concerns (the teeth are extracted for other reasons) ;

If done in a dental hospital, relatively high availability of human teeth ;

Relatively cheap and easy to do (except for the histological procedure) ;

It serves as a 3D *in-vitro* cell-culture model.

### **Challenges**

If there is no dental clinic or hospital nearby the lab, it is challenging to find enough teeth ;

The histological processing of teeth is relatively difficult to perform ;

Some expertise is needed before obtaining high-quality images.

### **Modifications**

The method can be further optimized if a kind of blood-pump is attached to the model (instead of blood, using cell-culture medium to feed the cells).

## REFERENCES, ASSOCIATED DOCUMENTS AND OTHER INFORMATION

### References

- Téclès, O., P. Laurent, S. Zygouritsas, A. S. Burger, J. Camps, J. Dejou, and I. About. "Activation of Human Dental Pulp Progenitor/Stem Cells in Response to Odontoblast Injury." *Arch Oral Biol* 50, no. 2 (2005): 103-8.
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- Pedano, M. S., X. Li, B. Camargo, E. Hauben, S. De Vleeschauwer, K. Yoshihara, K. Van Landuyt, Y. Yoshida, and B. Van Meerbeek. "Injectable Phosphopullulan-Functionalized Calcium-Silicate Cement for Pulp-Tissue Engineering: An in-Vivo and Ex-Vivo Study." *Dent Mater* (2020).

### Associated documents

- [Pedano MS, Li X et al. Dent Mater 2020.pdf](#)
- [Survival of human dental pulp cells...J of Dent 2019..pdf](#)
- [Biodentine induces TGF-B1 release. Laurent P, About I, et al. IEJ 2012.pdf](#)
- [Human tooth culture and biocompatib pulp capping. About I, Tecles O et al. Journal of Biomed Materials Res part B 2007\\_.pdf](#)

### Other remarks

This Human Tooth Culture model was developed and firstly published by the group of Prof. Imad About (Aix-Marseille University) :

Téclès, O., P. Laurent, S. Zygouritsas, A. S. Burger, J. Camps, J. Dejou, and I. About. "Activation of Human Dental Pulp Progenitor/Stem Cells in Response to Odontoblast Injury." *Arch Oral Biol* 50, no. 2 (2005): 103-8.

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