

## Organ culture: a tooth model evaluation of pulpal reactions to materials

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**INTRODUCTION:** This study validates a full tooth organ model for evaluating the pulpal response to direct and indirect pulp capping biomaterials, under experimental conditions as close as possible to the clinical situation.

**METHODS:** Human immature third molars extracted for orthodontic reasons were used in this work. After preparation and obturation of cavities, the extracted teeth were cultured for 1, 14 or 28 days.

- Controls (group A) were composed of 5 dentin cavities and 5 cavities with pulpal exposure without any filling materials.
- Cavities with pulpal exposure (group B, n=8) were sealed with calcium hydroxide XR®
- Dentin cavities (group C, n=12) were sealed with Xeno III®-Quixfil®, an adhesive and resin system.

Haematoxylin-eosin staining and Masson trichrome staining were used together with immunohistochemistry.

**RESULTS:** In all groups of cultured teeth, haematoxylin-eosin staining and Masson trichrome staining showed an organization of histological structures similar to that in normal dental teeth: tubular dentin, predentin, odontoblasts, fibroblasts and vessels (fig. 1). The pulp viability was maintained at 28 days.



Fig 1 Histological controls at 14 days, group A pulpal cavity (A) and dentin cavity (B)-residual dentine barrier-.

Calcium hydroxide in direct capping induced the formation of mineralisation nodules. Molecular investigation showed that these nodules were characteristic of reparative dentine secreted by functional odontoblasts expressing dentin sialoprotein and nestin (fig. 2).

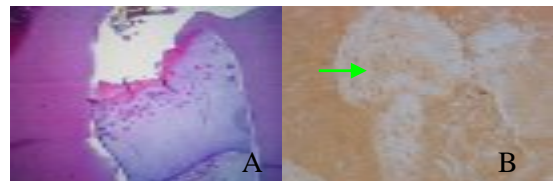


Fig. 2: At 28 days, mineralisation nodules in cavity with pulpal exposure sealed with calcium hydroxide (A) and the dentin sialoprotein-immunolabelling localised in the nodules (B).

The adhesive system in indirect capping initiated a vacuolisation, which disappeared at 28 days, and decreased the specific protein expression. Pulp viability was maintained (fig. 3).



Fig. 3: At day 1, the dentin cavity group showed a vacuolisation (A). At day 28, collagen I was expressed in dental pulp cells and the vacuolisation had disappeared (B).

**DISCUSSION & CONCLUSIONS:** The positive nestin immuno-labelling showed the presence of functional odontoblasts and the production of reparative dentin in group B. The toxicity of resin monomers was confirmed in this study but the ability of the dentin-pulp complex to respond to a variety of pathological conditions and injury was maintained. This organ culture model, which simulated the clinical situation of direct and indirect pulp capping, showed the same results as pulp-capping *in vivo*. This model could thus be a valuable tool to examine the mechanisms involved in pulp repair and regeneration.

**REFERENCES:** <sup>1</sup> O. Téclès, *et al.* (2005) Activation of human dental progenitor/stem cells in response to odontoblast injury, Arch Oral Biol. <sup>2</sup> I. About, *et al.* (2000) Human dentin production *in vitro*, Exp Cell Res. <sup>3</sup> H. Magloire, *et al.* (1996) An *in vitro* model of dental pulp repair, J Dent Res.