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Original Article

Human ex vivo dentin-pulp complex preservation in a full crown model

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ABSTRACT

Objectives: Currently, there is lack of human in vitro full tooth models that hold the odontoblast layer with pulp tissue in their native environment. The appearance of new in vitro and in vivo models has provided new understanding of the potential of tissue engineering in dental pulp regeneration. However, the development of new in vitro full tooth models will allow us to get closer to in vivo conditions. Thus, the aim of this study is to preserve a living dentin-pulp complex, in a novel in vitro full crown model, after tooth extraction.
Methods: Twenty intact third molars, after preparation, were divided into four groups, with five samples each. We placed the negative control samples (C) in saline, and the tested groups were placed (T) in supplemented DMEM, at two different times: 1 and 7 days. The specimens were processed for light microscopy observation.
Results: Contrary to C-groups, T-groups showed a functional dentin-pulp complex. The treated dentin-pulp complex presents normal histological appearance.
Conclusions: This study showed that it is possible to preserve a living dentin-pulp complex after tooth extraction during 7 days.

1. Introduction

Odontoblasts are post-mitotic specialized pulp cells, organized in a pseudostratified palisade layer.[1,2] At the dentin-pulp interface, odontoblasts are connected by junctional complexes, from where each cell projects an odontoblastic process into the pre-dentin/dentin matrix.[3] These cells are strategically placed and plays a key role in the first response of the dentin-pulp complex to injury.

Dentin-pulp complex is fundamental to the functional life of the tooth and its complex interaction during development, injury, defence or regeneration ensures the tooth response to growth, damage or aging.[4] Besides, the pulp cell activity and the signaling processes are crucial to the odontoblasts' behavior and fate.

The main goal of pulp therapies is to maintain vitality of pulp tissue, which is crucial to the functional life of the tooth.[5] However, in cases of irreversible pulpitis, pulp necrosis and periapical disease, the aim becomes the reestablishment of a vital and organized dentin-pulp complex.[6]

In the past two decades, the pursuing of new endodontic regeneration therapies gave rise to new culture models. Presently, there are in vitro and in vivo models to study dental pulp regeneration. In vitro models can be classified as two-dimensional (2D), three-dimensional (3D), and organ culture models. Organ culture models comprises in vitro full tooth models[7] and in vitro tooth slice models.[8–12] These models mimic in vivo conditions, providing an environment to test cells or substances.

Formerly, primary odontoblasts have been cultured pulpless.[13] These pulpless methods contributed to study odontoblast polarity[14] and the effect of growth factors.[15] Recently, there was enzymatic isolation of viable human odontoblasts.[16] Nevertheless, pulpless tissue cultures leave out the dentin-pulp complex dynamics and the symbiosis between odontoblasts and the pulp tissue.

The methodology used in this study consisted on an in vitro full crown model. The hypothesis was that the dentin-pulp complex

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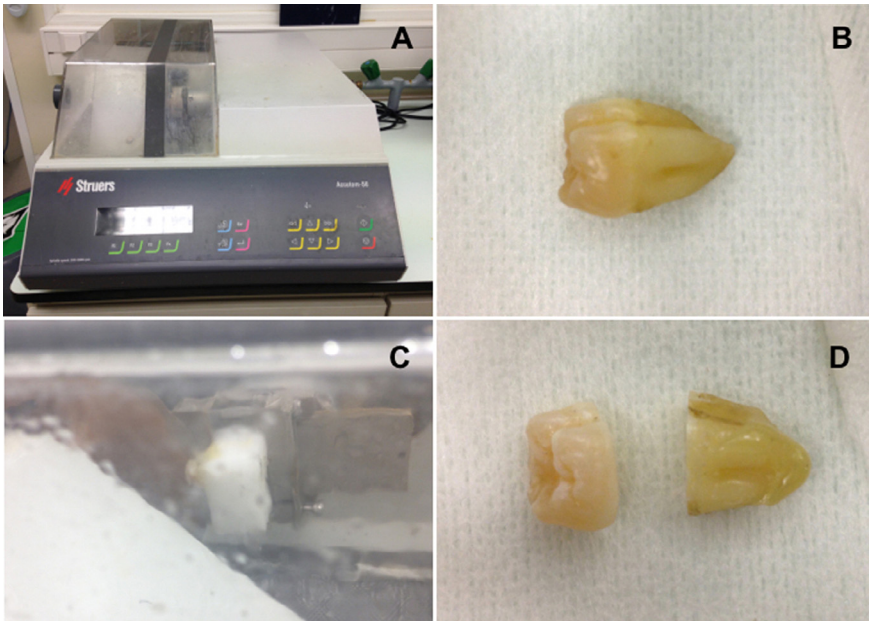

Fig. 1. Automatic microtome Struers Accutom 50 (A) was used to cut each tooth, immediately after surgery and cleaning (B). The cut was performed at 3200 rpm, 0.350 mm/s speed and irrigation (C), which gave rise to 2 specimens (D).

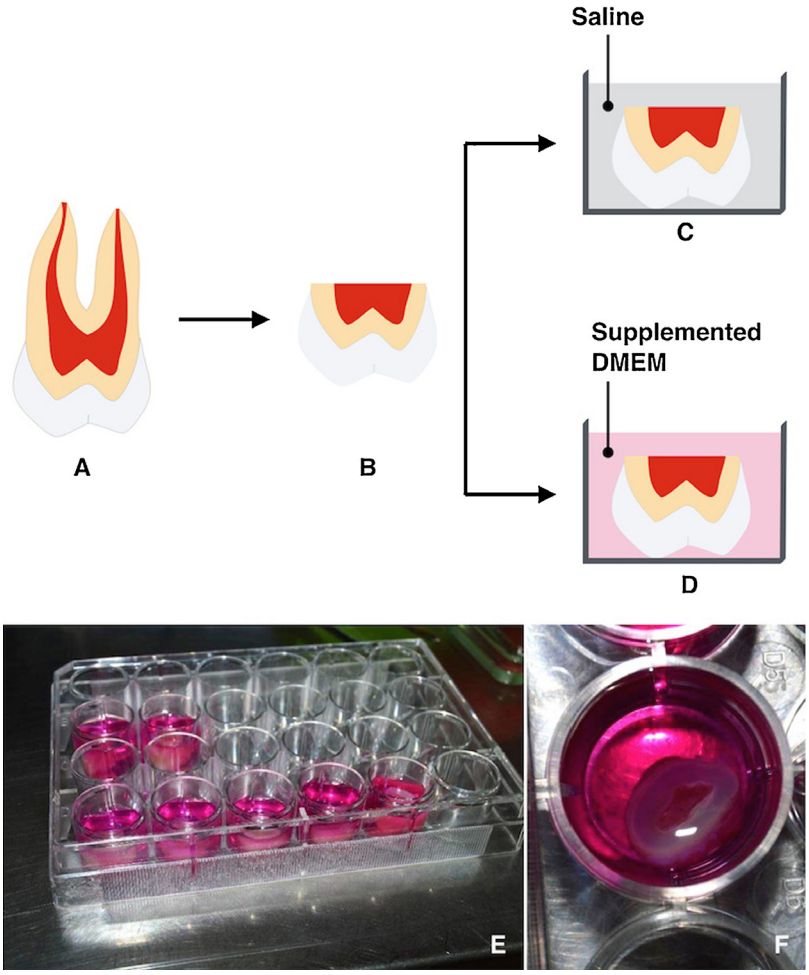

Fig. 2. Summarized schematic of the in vitro full crown model. After extraction (A), all teeth were prepared (B), and then the specimens were placed with the crown bottom-faced and the dentin-pulp complex exposed, and submerged by the respective medium. The samples from the negative control group were placed in saline (C). The samples from test groups were cultured in supplemented DMEM (D–F).

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