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In vitro characterisation of the dentinogenic potential of Mineral Trioxide Aggregate

Aim To provide an explanation for the biological effects of Mineral Trioxide Aggregate in vital pulp therapy.

Methodology Mouse odontoblast-like cells (MDPC-23) were grown on 24 hr set Mineral Trioxide Aggregate (MTA) for 24 hours and examined by scanning electron microscopy (SEM) for biocompatibility. Samples of normal human dentine were extracted with EDTA (10%), calcium hydroxide (0.02 M) and the soluble products of MTA (1.72 g in 1000 ml of water). The resulting extracellular dentine matrix protein preparations (E-DMP's) were analysed using 1DPolyacrylamide Gel Electrophoresis. A sandwich ELISA technique was employed to determine the concentration of TGF-b1 in each matrix preparation. MDPC-23 cells were exposed to concentrations of 1, 100, 1000 mg/mL of these matrix preparations for 24 h and analysed by reverse transcription – polymerase chain reaction (RT-PCR) to determine expression of TGF-b1.

Results MDPC-23 cells were observed to grow well on MTA over the 24 h culture period. MTA solubilised E-DMP's throughout the experimental period of 14 days whereas the action of calcium hydroxide was minimal after day 7. The protein profile identified by 1D PAGE analysis demonstrated a more diverse profile for E-DMP's solubilised with MTA. ELISA showed a higher concentration of TGF-b1 in E-DMP'S extracted with soluble products of MTA than calcium hydroxide. MTA solubilised E-DMPs caused significant up-regulation in gene expression for TGF-b1.

Conclusions MTA is capable of solubilising a heterogeneous profile of matrix components from human dentine over extended periods of time. The matrix components solubilised included the growth factor TGF-b1 and demonstrated bioactive properties on regulation of gene expression in odontoblast-like cells. The interactions of MTA with the cells and matrix in the dentine-pulp complex may complement its biocompatible properties and contribute to its biological effects on dentine bridge formation and regeneration in these tissues.

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