The Effects of Mineral Trioxide Aggregate (MTA) on Human Periodontal Ligament Cells

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Abstract: Since mineral trioxide aggregate (MTA) was developed and reported as an endodontic restoration in the early 1990s, it has been shown that this material offers excellent biocompatibility with the hard tissue on its surface when used for direct pulp capping, furcal repair, repair for root perforation, root-end filling, and apexification, and for inducing tissue regeneration around the filled portion. However, the effects of MTA on the periodontal ligament tissue remain unclear, so this study evaluated the effects of MTA on the attachment, proliferation, and differentiation of human periodontal ligament fibroblasts (HPLF). Two populations of HPLFs derived from two patients were co-cultured with MTA discs (9 mm in diameter and 1 mm thick). In 24 hours of co-culture, HPLF attached to MTA with both a rough surface and a smooth surface, independently of its surface features. Furthermore, the effects of the variation of cell number seeded on MTA on the proliferation were estimated. When HPLF was seeded at a lower cell density, the proliferation of HPLF was restricted almost completely compared with the control cultured on plastic, while when seeded at a higher cell density, the proliferation rate was similar to the control. HPLFs co-cultured with MTA exhibited induced mineralization after 4 weeks of culture. In 4 days of the culture of HPLF with 5 mmol/l CaCl₂, the expression of both osteopontin (OPN) and osteocalcin (OCN) mRNAs was induced, and after 4 weeks of culture, mineralization in both HPLFs was also observed. These results indicated that MTA has cell compatibility for HPLF, and induces the osteoblastic/cementoblastic differentiation of HPLF through calcium released from MTA.

Key words: Human periodontal ligament fibroblasts, MTA, Mineralization