Symposium I

Biologic effects and Clinical applications of Mineral Trioxide Aggeregate (MTA)

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Mineral Trioxide Aggregate (MTA) has recently been introduced to the field of clinical endodontics as a promising material for retrofilling, perforation and other repairs. The main constituents of MTA are very similar to Portland cement, i.e. tricalcium silicate (CaSiO4), Bismuth oxide (Bi2O3), dicalcium silicate (2CaOSiO2), calcium sulphate (CaSO4), tricalcium aluminate (3CaOAl2O3), tetra calcium aluminoferrite (4CaOAl2O3FeO3) and an amorphous structure consisting of 33% calcium, 49% phosphate, 2% carbon, 3% chloride and 6% silica. Results of MTA studies from dogs and monkeys demonstrated that MTA caused significantly less inflammation than amalgam. More importantly, cementum bridges formed directly over the MTA retrofillings . In addition to superior sealing ability and biocompatibility, MTA appears to have the capacity to promote bone and dentin formation. Despite these promising biological properties, neither its effects on periapical tissues nor mechanisms of hard tissues induction are well understood.

1. Biologic effects of Mineral Trioxide Aggeregate (MTA) on Periapical Tissues and Cells

Objective: In this study, we have used in vivo animal as well as in vitro cell culture approaches to better understand the osteo- and dentino-inductive properties of MTA

Materials and methods:

Animal experiments

Infected teeth in beagle dogs were subjected to intentional furca perforation, apicoectomy with MTA seals and intentional tooth replantation. After 3-6 months of the retention period, these teeth and surrounding tissues were removed and processed for hard tissue histology.

In vitro cell culture experiments

Primary mouse osteoblasts, odontoblast cell line (MDPC23), and human dental pulp stem cells were seeded on culture dishes coated with or without MTA. The effects of MTA on biocompatibility, cell proliferation and gene expression were studied by SEM, MTT assays and Northern blot analysis, repectively.

Differences in extracellular[Ca2+] were also compared between cultures grown on MTA and on plastic.

Results

Animal experiments

Increased bone formation near the perforation was a consistent finding for MTA-filled teeth. Some sections also showed a thin layer of cementum-like tissue sealing the apices, suggesting that MTA may have a previously unrecognized cemento-inductive property. Strikingly, a periodontal ligament-like projection was occasionally observed between newly formed bone and MTA. This interesting property is clinically significant in that normal structure and function of the PDL may be restored when MTA is used as a restoration material.

In vitro cell culture experiment

Cells grown on MTA were tightly attached to the surface and divided at a much higher rate than cells grown on plastic. In spite of the increased rate of cell proliferation, the cellular phenotype was maintained as evidenced by osteogenic/dentinogenic gene (Runx-2, osteopontin and osteocalcin) expression

Conclusion:

The findings from this study clearly demonstrate that MTA is a unique dental material, broader application of which can be easily envisioned with some modifications of its physical properties.

2. Clinical Application of MTA

- Root-end filling for apical surgery.
- Repair of root perforations; repair material for furcation perforation, strip perforation and post perforation
- Repair for Root Resorption
- Apical MTA plug; One Visit Apexification
- Pulp capping and Pulpotomy
- Treatment for unusual anatomy

경력

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