7

Clinical applications of MTA

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Introduction

An mineral trioxide aggregate(MTA) has recently been introduced as a potential alternative restorative material to the presently used materials in endodontics.

Exposure of the dental pulp and periradicular tissues to microorganism results in the development of pulpal and periradicular pathosis.

Many materials have been to seal the pathways of communication between the root canal system and the oral cavity, as well as the periradicular tissues.

These include: amalgam, super EBA, IRM, Cavit, composite resins and glass ionomer cements. The main disadvantages of these materials include: microleakage, toxicity, and sensitivity to the presence of moisture.

Several in vitro and in vivo studies have shown that MTA prevents microleakage, is biocompatible, and promotes regeneration of the original tissues when it is placed in contact with the dental pulp or periradicular tissues.

It can be used for: pulp capping, as an apical plug in teeth with open apexes, as a repair material for root perforation, and as a root end filling materials during endodontic surgery.

In this article, one case of apical plug in tooth with open apex and two cases of perforation repair with MTA are presented.

Clinical cases

• Case I

A 24-year old male patient presented with discoloration on right maxillary lateral incisor. A radiography revealed immature apex and large periapical radiolucency and incomplete canal filling material. The tooth was tenderness to percussion and palpation but mobility was minimal and had a temporary filling in the acess cavity.

The patient's history revealed that the tooth was avulsed fourteen years ago when he was ten years old and replanted by dentist but had no treatment.

When he fell down two years ago, he had complicated coronal tooth fracture on both maxillary central incisors. After root canal treatment was completed, crown restoration done on both maxillary central incisors. and also root canal treatment on the right maxillary lateral incisor.

At the first visit, the tooth was isolated with rubber dam, canal filling material removed and irrigated with

NaOCl. After working length determined, we prepared canal and placed intracanal dressing with calcium hydroxide for disinfection.

A week later, the MTA powder mixed with saline was carried to the canal and gently condensed. Moist cotton pellets were placed in the canal and the access cavity was sealed with IRM. A radiography was taken for checking its extension.

The next day, the rest of the canal was obturated with Obtura Ⅱ.

After walking bleaching completed, the access cavity was sealed with light curing glass ionomer cement.

After 6 months the tooth was no symptom and functioned well. A radiograph showed increased radiodensity around the apex but not obvious.

The 12 months cater radiograph showed the decreased radiolucency around the apex.

A periodic recall check will be necessary.

• Case Ⅱ

A 20-years old female patient presented with intermittent dull pain on the left mandibular first molar. The tooth had root canal treatment about 6 months ago at the local clinic. She visited to student-case clinic for the crown restoration, but felt discomfort on #36 tooth, so referred to the department of conservative dentistry.

A radiograph showed the perforation in apical 1/3 of mesiobuccal root.

At the first appointment, gutta-percha was removed using chloroform, the canal was irrigated with NaOCl and working length determined.

At the second visit, the perforated apical area of the mesiobuccal canal was cleaned, shaped and filled with gutta-percha using lateral condensation method.

Perforation area was repaired with MTA.

Two days later, the canal was back-filled with Obtura Ⅱ.

The next appointment, all other canals were cleaned, shaped and filled.

After six months later, a radiograph revealed excellent healing around mesiobuccal root. The tooth was asymptomatic and had a post and crown restoration and normally functioned.

• Case Ⅲ

A 26-year old female patient was referred for the evaluation and treatment on left maxillary lateral incisor. Tooth had a gold post and PFG crown restoration at the private office about 4 years ago. The PFG crown had been lossed 2 weeks ago and she experienced dull pain and pus discharge.

A radiography showed middle 1/3 root perforation by a post and slightly radiolucency around the perforation site. Clinical examination revealed deep probing depth(near apex) on mesiobuccal side. The tooth responded to percussion to and had fistula.

Because the post was too wide and long to be removed, we decided surgical intervention.

At the next appointment, we raised mucoperiosteal flap and located perforation site and then, we prepared cavity in the mesial side of root with ultrasonic and diamond bur. After MTA was placed in perforated site, flap repositioned and sutured.

One month later, the tooth was asymptomatic, and no tenderness, mobility and the fistula was disappeard.

Three months later, the probing depth was decreased to about 5mm.

Six months later, the probing depth was about 3mm and the tooth had no symptom and normally functioned.

Discussion

In endodontic practice, procedural accidents such as perforation may occur and affect the prognosis of root canal treatment. Perforations were reported the second greatest cause of endodontic failure and account for 9.6% of all unsuccessful cases.

Perforation has a notably detrimental effect on prognosis and predisposes a tooth to periradicular breakdown.

Many dental materials have been used and tried as repair for perforation but they do not consistent results. Unlikely most repair material, MTA has a better sealing ability because it is more biocompatible than currently used materials.

Apexification with calcium hydroxide usually takes a long time. This means that final restoration should be delayed. With MTA, the barrier is almost immediate, allowing the final restoration to be done in a short time.

A material called mineral trioxide aggregate(MTA) has been investigated as a potential compound to seal off the root canal system and the external surface of the tooth.

Principal compound of this material are tricalcium silicates, tricalcium aluminates, and tricalcium oxide silicate oxide, there are a few other mineral oxides which are responsible for the chemical and physical properties of this aggregate. The powder consists of fine particles which are hydrophilic and set in the presence of water.

Hydration of the powder results in a colloidal gel with a pH of 12.5 that solidifies to hard structures. The setting time of this cement is about 4 hours. The compressive strength of MTA is comparable with that of IRM and Super EBA.

The sealing ability of MTA is superior to amalgam and equal or superior to Super EBA. The cytotoxicity of MTA is less than that of IRM or Super EBA. Furthermore, MTA has an inductive effect on cementoblasts, cementum formation over MTA.

Based on these, It seems that MTA has several potential clinical applications and alternative restorative material to the presently used materials in endodontics.