Evaluation of the repair of furcation perforations using mineral trioxide aggregate or BioAggregate in dogs

E. Hassanien, A. Abu-Seida, A. Hashem and S. Khanbash
introduction
• Perforation can be defined as a mechanical or pathological communication between the root canal system and the external tooth surface.

• Furcal perforation is a common cause of endodontic failure
Main causes are:

- Iatrogenic, throughout the course of endodontic access opening due to an incorrectly directed bur.

- As a result of extension of internal resorptions into the periradicular tissues
• In clinical endodontics, there are several filling materials for perforation repair as MTA, MTA Angelus, MTA-Bio and BioAggregate.

• Mineral trioxide aggregate is the gold standard for perforation repair because of its predictable periodontal ligament regeneration and cemental deposition.
- MTA is composed of dicalcium silicate, tricalcium silicate, tricalcium aluminate, and tetracalcium aluminoferrite.

- BioAggregate is a relatively new bioceramic based material which is similar to MTA, promotes cementogenesis, has antibacterial effect and forms a hermetic seal inside the root canal.

Introduction
MTA and BioAggregate were found to have similar chemical composition except for the absence of aluminium and presence of significant amount of tantalum oxide in BioAggregate. Tantalum oxide acts as a radiopaque substance instead of bismuth oxide, which is present in MTA.
The aim of this study was to evaluate the healing of furcation perforation following treatment with MTA or BioAggregate.
Materials and methods
The research proposal was approved by the ethical committee at Faculty of Dentistry Ain Shams University and by the animal use and care committee at Faculty of Veterinary Medicine, Cairo University, Egypt.
Materials and methods

Total teeth 54 premolars
6 dogs

Group I
(one week)
(18 teeth, 2 dogs)

Group II
(one month)
(18 teeth, 2 dogs)

Group III
(3 months)
(18 teeth, 2 dogs)

MTA subgroup
(6 teeth)

Bioaggregate subgroup
(6 teeth)

Positive control
(6 teeth)
General Anesthesia

Creation of endodontic access cavity through the occlusal surface

Removal of pulp tissue

Obturation of root canals by Gutta percha core and Endo-fill cement

Materials and methods
Creation of 1.4 mm furcation perforation

Infection period for 4 weeks

Pain control for 5 postoperative days
Re-anesthesia after the infection period

Preoperative radiography

Curetting, cleaning and drying of the perforation sites

Treatment of the perforation with either MTA or Bioaggregate
The furcation perforation left open in positive control subgroup

Filling of the access cavity with Glass Ionimer cement

Post operative radiography
Assessment of vertical bone loss at the perforation sites by comparison between pre- and post operative radiographs using TurboReg Plug-in software

Histological evaluation included; inflammatory cell count, epithelial proliferation and hard tissue formation

Statistical analysis of all results by SPSS
Results
### Results

<table>
<thead>
<tr>
<th>Subgroups</th>
<th>Subgroup (a) (MTA)</th>
<th>Subgroup (b) (BioAggregate)</th>
<th>Subgroup (c) Positive control</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group I</strong> (One week)</td>
<td>6.4±1.1 (^a)</td>
<td>6.3±1.3 (^a)</td>
<td>7.7±1.9 (^a)</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td><strong>Group II</strong> (One month)</td>
<td>4.8±1.1 (^b)</td>
<td>4.7±3.8 (^b)</td>
<td>10.1±3.3 (^a)</td>
<td>&lt;0.001*</td>
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<tr>
<td><strong>Group III</strong> (Three months)</td>
<td>2.9±1.4 (^b)</td>
<td>2.8±1.4 (^b)</td>
<td>11.6±2.4 (^a)</td>
<td>0.007*</td>
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</table>

Percentual mean of bone loss among different groups and subgroups
### Results

<table>
<thead>
<tr>
<th>Subgroups</th>
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<th>Group II (One month)</th>
<th>Group III (Three months)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subgroup (a)</td>
<td>770.5±23.1 b</td>
<td>554.4±18.7 b</td>
<td>305.9±22.1 b</td>
<td>703.9±22.2 b</td>
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Mean inflammatory cell counts among different subgroups and groups
## Results

Frequencies and percentages of epithelial proliferation in different subgroups and groups.

<table>
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<tr>
<th></th>
<th>Groups</th>
<th>Subgroups</th>
<th>Group I</th>
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<th>Group II</th>
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<th>Group III</th>
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<tr>
<td></td>
<td></td>
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<td>Frequency</td>
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<td>%</td>
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<td>MTA subgroup</td>
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<td>8.0</td>
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<td>3.0</td>
<td>42.9</td>
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<td>Positive control</td>
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<td>3.0</td>
<td>100</td>
<td>3.0</td>
<td>75.0</td>
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<td>P-value</td>
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<td>0.161</td>
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<td>0.076</td>
<td>NC**</td>
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<td>MTA subgroup</td>
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<td>12.5</td>
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<td>37.5</td>
<td>4.0</td>
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<tr>
<td>BioAggregate subgroup</td>
<td>1.0</td>
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<td>37.5</td>
<td>4.0</td>
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<td>Positive control</td>
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</table>

Results

Frequencies and percentages of prevalence of new hard tissue formation among different subgroups and groups
Representative radiographs after 3 months of treatment with MTA (a), BioAggregate (b) and positive control (c)
Results

Photomicrograph showing severe inflammatory cells infiltration in subgroup Ic (positive control) (H&E X40). FP; furcation perforation. PDL; periodontal ligament. (b) Photomicrograph showing dense epithelial proliferation in subgroup IIIc (positive control) (H&E X 200).
(c): Photomicrograph of subgroup IIIa showing new hard tissue over the MTA (H&E X40). B; bone, D; dentine, PDL; periodontal ligament, MTA; mineral trioxide aggregate. (d) Photomicrograph of subgroup IIIb showing new hard tissue over BioAggregate (H&E X40). D; dentine, PDL; periodontal ligament, Bio; BioAggregate.
conclusions
• Both MTA and BioAggregate had a similar biological response on the periodontal tissue of dogs.
• There is no significant difference between MTA and BioAggregate regarding furcation radiolucency, inflammatory cell count, epithelial proliferation and new hard tissue formation.
• Both MTA and BioAggregate cements are good materials for furcation perforation treatment in dogs
Thank You!