INTRODUCTION

Traumatic injuries are common amongst young children because of outdoor sports activities and accidents at home or school. Dental trauma primarily occurs in the anterior part of oral cavity, affecting the maxillary jaw more than the mandibular jaw. The injuries include avulsion, intrusion, lateral displacement, fracture and concussion. In most cases, such traumatic injuries leads to cessation of tooth development, resulting in an incompletely formed apex, large root canals and weak and fragile walls. These features retard root canal instrumentation and prevent the establishment of an adequate apical stop. In such cases, in order to condense the obturation material and to establish the apical seal, it is essential to create an artificial apical barrier or to induce an apical closure with apexification procedure.

Calcium hydroxide has been used famously in the past for induction of apical barrier, having success rates ranging from 79%-96%. However, being a long history of use in apical closure procedures, there are many drawbacks associated with the use of calcium hydroxide for apexification procedure. These include increased time period for root apical closure, multiple of dressings of calcium hydroxide are important to complete apical closure, severity of infection, and the fracture resistance of the teeth after long term use of calcium hydroxide. Depending on the case severity, barrier formation is reported to take approximately 3- 24 months.

In recent advancement in terms of introduction of new materials, researchers have been experimenting with materials, capable of being applied permanently at the apical area of the root to establish an artificial barrier.

COMPARISON OF EFFECTIVENESS OF MINERAL TRIOXIDE AGGREGATE AND CALCIUM HYDROXIDE IN APEXIFICATION PROCEDURE

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4.BADER MUNIR

ABSTRACT

An incompletely formed apex (open apex) is one of the most common features seen in immature permanent teeth after dental trauma. Endodontic treatment of open apex teeth presents with problems of overfilling and poor apical seal, thus it is imperative to create an artificial apical barrier or to induce apical closure with calcified tissue. Different materials have been tried for Apexification procedure, the most common are calcium hydroxide and mineral trioxide aggregate (MTA). The objective of this article was to compare the effectiveness of Mineral Trioxide Aggregate and Calcium hydroxide in creating apical closure.

This is a comparative study of 80 patients with Open Apex teeth. They were randomly allotted into two groups (Group A and Group B). In Group A (40 patients), calcium hydroxide was used as an apexification material, While in Group B (40 patients) apical plugs were produced with mineral trioxide aggregates (MTA) followed by obturation.

In Group A, 30 patients showed complete absence of lesion while in Group B, 37 patients showed complete healing. Ten patients showed no healing in Group A, because of improper packing of material into the canal, while only three patients showed no healing in Group B because of poor delivery of MTA to the apex. The results showed that 75% teeth had complete healing in Group A and 92.5 % had complete healing in Group B. The results of the study concluded that MTA is significantly better than Ca (OH)2 in Apexification of non-vital immature permanent teeth.

Key Words: immature permanent teeth, Apexification, calcium hydroxide, MTA.
apical barrier to reduce the process of treatment in one or two appointments. Another alternative is to establish an artificial apical stop with mineral trioxide aggregate. MTA is a potential apical barrier material with excellent sealing properties, greater biocompatibility, low solubility, can be used safely when placed next to pulp and periradicular tissues.

**MATERIAL AND METHODS**

This randomised control trial was conducted on 80 open apex cases visiting Department of Operative Dentistry, de’Montmorency College of Dentistry/Punjab Dental Hospital, Lahore from May 2010 to November 2010.

Informed consent for participation in the study was obtained from each patient. The Patients were divided into two groups using random number table.

In Group A (n=40) Calcium Hydroxide mixed with normal saline, was packed inside the canal with lentulo spiral and coronal access was sealed with glass ionomer. In Group B (n=40) MTA plug (3-4mm) was formed at the apex and dam cotton pledget was placed within the coronal access and then after gaining hard MTA plug, obturation was followed. Post-operative radiographs were taken after placement of both materials. Then follow up radiographs were taken after 3 and 6 months duration. Healing was observed both clinically and radiographically and barrier formation was observed radiographically.

This comparative study was conducted in Operative Dentistry Department of de’Montmorency College of Dentistry and Punjab Dental hospital Lahore. A total of 80 patients were treated. Out of 80, 54 were male (65%) and 26 were female (35%) The age of patients was between 7 to 30 years (Table 1).

**RESULTS**

Radiographic evaluation of teeth in both groups revealed that In Group A, 30 patients showed absence of radiolucency while 10 patients showed presence of lesion after 3 months (Table 2). Out of 10 failure cases, 2 patients showed pain and 4 showed swelling clinically, while 4 of them showed radiolucency radiographically (Table 3).

In Group B, 37 patients showed absence of radiolucency and only 3 patients showed presence of lesion after 3 months (Table 2). Out of 3 failure cases, one showed swelling clinically while 2 of them showed radiolucency radiographically (Table 3).

The overall success rate in Group A was 75% and in Group B 92.5%. Success rate was significantly higher in Group B than Group A (p value= 0.034) (Table 4).

**DISCUSSION**

Management of immature, non-vital permanent anterior teeth with blunderbuss apex include surgery, retrograde sealing, apical plug formation by dentinal chips, calcium hydroxide apexification and recently introduced mineral trioxide aggregate (MTA) apical plug formation followed by obturation and coronal restoration.

According to Hakki et al, MTA provides an ideal environment that promotes cementum regrowth and having ability to induce dental pulp and periradicular tissue regeneration. A study by Tahan E et al, observed that complete periapical healing takes place despite extrusion of MTA. This attributed biologic properties of the MTA. At 12 months, the radiograph showed complete bony healing of preoperative periapical pathosis.

In review of 10 studies, Sheehy and Roberts reported that the use of calcium hydroxide for apical closure was successful in 74-100% of cases irrespective of the proprietary brand used. They also studied that long term follow up was important and information for long-term outcomes was limited. Drawbacks such as reinfection and cervical root fracture could occur.

In another study, ElMeligy and Avery examined a total of 30 teeth. They were evenly divided into control group (Ca(OH)₂ apexification), or the experimental group (MTA apexification). Clinical and radiographic evaluations were carried out after 3, 6, and 12 months. The results concluded that the clinical and radiographic success rate for MTA was 100% and for the Ca(OH)₂ it was 87%. They concluded that MTA could potentially...

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**TABLE 1: ANALYSIS OF AGE**

<table>
<thead>
<tr>
<th>Mean age + St.D</th>
<th>15.19 ± 4.10</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum age</td>
<td>9</td>
<td>0.045</td>
</tr>
<tr>
<td>Maximum age</td>
<td>28</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 2: COMPARISON OF EFFECTIVENESS BETWEEN GROUPS**

<table>
<thead>
<tr>
<th>Effectiveness</th>
<th>Group A</th>
<th>Group B</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective</td>
<td>30</td>
<td>37</td>
<td>0.034</td>
</tr>
<tr>
<td>Non Effective</td>
<td>10</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 3: CLINICAL AND RADIOGRAPHIC EVALUATION AFTER 3 MONTHS FOLLOW UP**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Pain</th>
<th>Swelling</th>
<th>Radiolucency</th>
<th>Failure cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Group B</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

**TABLE 4: COMPARISON OF SUCCESS RATE BETWEEN BOTH GROUPS AFTER 3 MONTHS FOLLOW UP**

<table>
<thead>
<tr>
<th>Groups</th>
<th>Total Patients</th>
<th>Failure</th>
<th>Success %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>40</td>
<td>10</td>
<td>75%</td>
</tr>
<tr>
<td>Group B</td>
<td>40</td>
<td>3</td>
<td>92.5%</td>
</tr>
</tbody>
</table>
be an excellent alternative for apexification.\textsuperscript{18}

In another study, Sarris et al used MTA for the apexification of non-vital immature teeth (incisors). They concluded that MTA has superior properties over Ca(OH)\textsubscript{2} when used as a root end closure material.\textsuperscript{19} Kinirons et al, used calcium hydroxide for apexification in immature incisors and evaluated that frequently changing the dressings of Ca(OH)\textsubscript{2}, rapid would be the establishment of hard tissue apical barrier, but many appointments would be needed for the whole procedure. While in case of MTA a minimum of two appointments are needed for the completion of procedure.\textsuperscript{20}

The necrotic immature permanent incisors treated with MTA required shorter duration for apexification than those treated with calcium hydroxide.\textsuperscript{21}

In another meta-analysis, Jia cheng Lin et al observed that MTA was associated with a significantly shorter duration for apexification than the calcium hydroxide. This is the utmost clinical significance because many failures with calcium hydroxide are due to lack of patient follow-up.\textsuperscript{22}

In another study done by Bonte et al observed that the MTA group showed better results in terms of apical closure.\textsuperscript{23} In another comparison study MTA was successful in terms of immediate obturation of immature roots with blunderbuss apices.\textsuperscript{24}

\textbf{CONCLUSION}

MTA is considered to be more effective in terms of closure of apical end of the root canal as compared to calcium hydroxide in immature permanent teeth in apexification procedure.

\textbf{REFERENCES}