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Research Article

Clinical and Radiographic Evaluation of Three Capping Materials in Pulpotomized Young Permanent Teeth

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Abstract

Aim: This study was to evaluate clinical and radiographic effects of three medicaments (Calcium hydroxide, Biodentine and Bioactive glass) on the pulp tissue of young permanent teeth.

Methodology: Pulpotomy procedure was performed in thirty young first permanent molars. After that, the radicular pulp is medicated either with biodentine, Bioactive glass or Ca (OH)2 and restored with Zn phosphate cement. After 48 Hours, 4 weeks, 3 month patients recalled and data collected will be tabulated and statistically analyzed.

Result: Clinical and radiographic assessments of the three groups referred90%, 60% and 80% success rates respectively, after 3 months follow up.

Conclusion: Biodentine can be used successfully as a pulpotomy medicament in young permanent teeth.

Keywords: *Capping Materials; Pulpotomized; Biodentine*

Introduction

Dental caries development is considered to involve a triad of indispensable factors, which can be concluded as bacteria in dental plaque, carbohydrates in diet and susceptible teeth [1].

Young permanent teeth are recently erupted teeth in which normal physiological apical root closure has not occurred, normal physiological root closure of permanent teeth may take 2 - 3 year after tooth eruption, young permanent teeth are in development stage in children from 6 years of age until mid-teens. Human tooth with immature apex is a developing organ [2].

Pulpotomy is surgical removal of the entire coronal pulp, leaving intact the vital radicular pulp within the canals to amputate the infected coronal pulp, neutralize any residual infectious process, preserve the vitality of the radicular pulp, and promote open root apices healing through use of different medicaments [3].

Some materials do better than others when placed on exposed pulps due to their ability to prevent bacterial contamination of the pulp [4]. Calcium hydroxide became recognized as a valuable pulpotomy material after its use for performing pulpotomy in [5].

Calcium hydroxide has several disadvantages: It loses its antibacterial capacity when it comes in contact with tissue fluid due to decrease in its alkaline pH, Calcium hydroxide is not a good material for sealing against bacterial penetration as bacteria can readily penetrate any remaining calcium hydroxide after its initial antibacterial action is over, It completely depends on the overlying restorative material to prevent bacterial penetration to the pulp [6].

Biodentine (calcium silicate based material) is other medicament that has several advantages which include good sealing ability, adequate compressive strength, and short setting time, which provide a significant clinical advantage over other comparable materials [7,8].

It is biocompatible and also shows bioactivity [9,10].

Bioactive glass (BG) is other medicament which has been widely used in bone regeneration; however, reports on the biological effects of BG on dental pulp cells are rare [11].

Aim of the Study

The objective of this study was to compare between the clinical and radiographic effects of three medicaments (Calcium hydroxide, biodentine and Bioactive glass) on the pulp tissue of young permanent teeth.

Materials and Methods

The present study was a longitudinal study comprising of thirty first permanent molars were included in this study, from child patients their ages ranged from (6 - 9) years. Patient should have, at least one, a deeply carious vital first permanent molar with incompletely root formed. A complete history was obtained and a thorough clinical examination was completed on each selected children.

Groups: The selected molars were divided randomly into three equal groups:

- **Group A:** Comprising 10 young permanent molars that were treated with biodentine (Septodont).
- **Group B:** Comprising 10 young permanent molars that were treated with Bioactive glass material (Biogran-biomet3i).
- **Group C:** Comprising 10 young permanent molars that were treated with Dycal® Radiopaque Calcium Hydroxide Composition (Dentsply).

Pulpotomy procedure

A surgically clean technique used throughout the procedure. The entire roof of the pulp chamber was removed. The pulp stumps cleanly excised with no tags of tissue extending across the floor of the pulp chamber. Cotton pellets moistened with normal saline were placed in the pulp chamber and allowed to remain over the pulp stumps until a homeostasis performed. Following the access cavity procedures and control of haemorrhage, the different capping materials were applied according to manufacture instructions. Protective layer of Zn phosphate cement was placed over the capping material in each of groups to provide an adequate seal.

Results

Clinical and radiographic findings of group A

Clinical and radio-graphical findings of the young permanent molars treated with Biodentine at different intervals are listed in table. All cases had no pain at the post- operative evaluation. At the following review appointments (4 weeks, 3 months), In one case was associated with swelling and recorded as treatment failure cases. For this reason, Apexification and/or endodontic treatment were performed for it. Radiographically, Only 1 molar showed evidence of widening in the periodontal membrane space. In addition, one of them exhibited periapical and furcation radiolucencies and considered as treatment failure cases. At last recall visit (3months) one molar have periapical and furcation involvement and increasing radiolucency and this accompanied with widening in the periodontal membrane space and considered as treatment failure case.

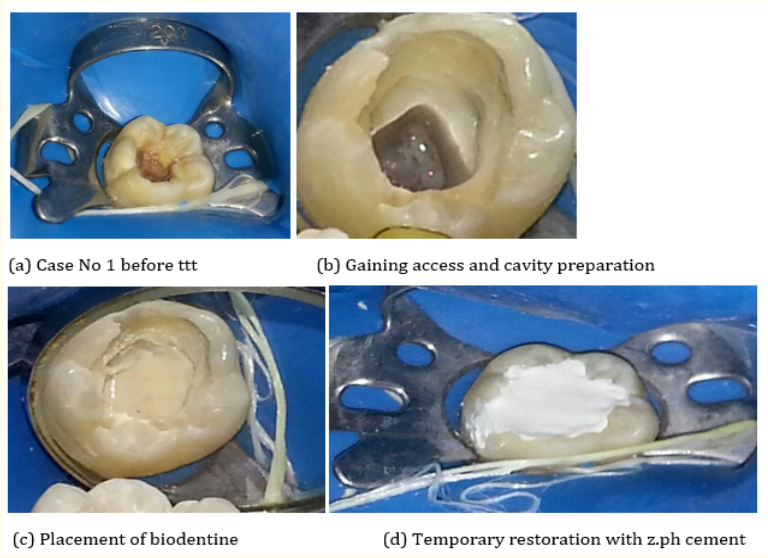

Figure 1: *Biodentine pulpotomy.*

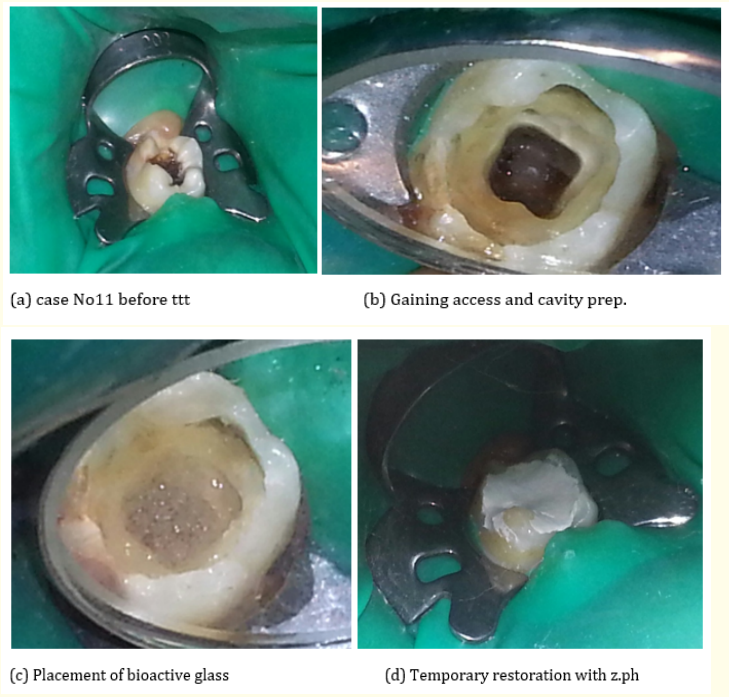

Figure 2: *Bioactive glass pulpotomy.*

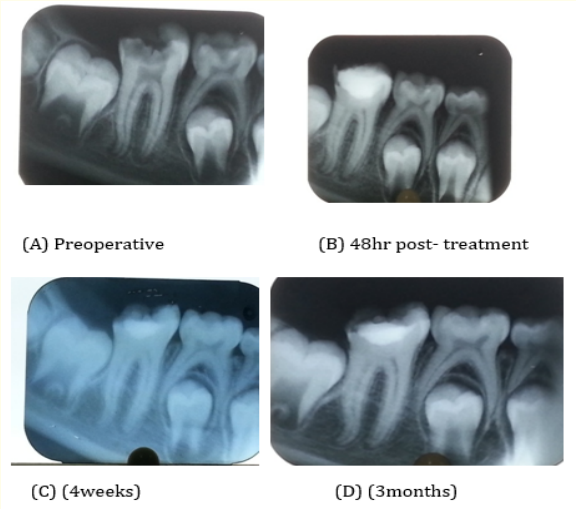

Figure 3: *Radiographic feature of case 1 treated with biodentine pulpotomy (Group A).*

Clinical and radiographic findings of group B

It was found that 6 teeth (60%) of the group were responded positively to Bioactive glass material and appear normal as evaluated and measured by clinical and radiographic assessments for 3 successive months while the remaining 4 teeth (40%) failed to respond positively. Dor this reason, Apexification and/or endodontic treatment were performed for them.

Clinical and radiographic findings of group C

Clinical findings of the young permanent molars treated with Calcium hydroxide at different intervals. Two cases had pain at the post-operative evaluation. At the following review appointments (48 hr). In two of them pain was associated with swelling and increased mobility (grade II) and recorded as treatment failure cases. For this reason, Apexification and/or endodontic treatment were performed for them. Radiographically Only 2 molars showed evidence of widening in the periodontal membrane space. In addition, these molars exhibited periapical and furcation radiolucencies and considered as treatment failure cases. At last recall visit (3months) tow molars have periapical and furcation involvement and increasing radiolucency and this accompanied with widening in the periodontal membrane space and considered as treatment failure cases.

Comparison between the three groups A, B and C

On comparing the success rate of the groups A, B and C. using the F-test.

Character	Biodentine (A)	Bioactive glass (B)	Calcium hydroxide (C)
Sub. No.	10	10	10
Success cases	9	6	8
Percentage	90%	60%	80%
Failed cases	1	4	2
Percentage	10%	40 %	20%
S.D.	0.330719	0.489898	0.4
Sig.	A:C = .035	B:C = .060	

Table

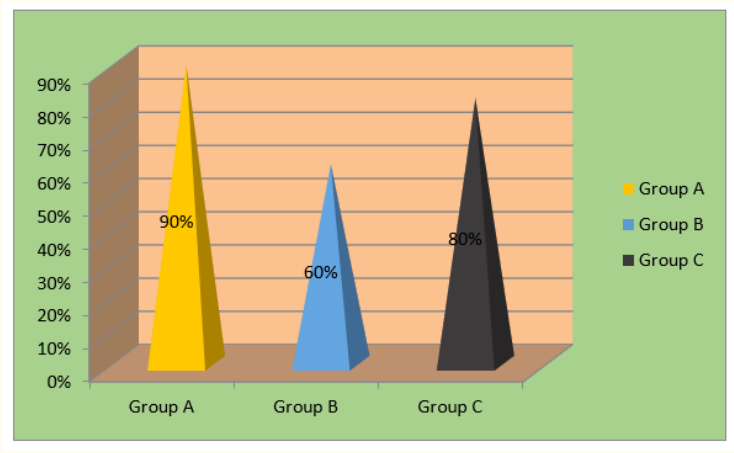

Figure 4: *Success rate of the groups (A), (B) and (C).*

Discussion

When biodentine was used in this study as a pulpotomy dressing, group (A), a success rate was (90%) which may be due to better sealing ability with a reduced setting time, anti-bacterial action and dentine bridge formation where biodentine increase calcium and TGF-ß1 secretion from pulp cells when placed in direct contact with the dental pulp which induce angiogenesis, cell differentiation and mineralization. This is in agreement with other searches [12,13]. In study of Nowicka., *et al.* [12] had concluded the success rate of biodentine pulpotomy was 95% which may be due to high alkalinity and better marginal sealing that prevent marginal leakage. Kusum., *et al.* [13] had found that success rate of biodentine pulpotomy was 100% at 6 months period follow-up and this may be due to bioactivity, short setting time (12 minutes), good handling, low solubility and mechanical properties similar to dentine.

In the present study, it was found that the success rate of BAG group (B) was 60% which may be attributed to antibacterial action and biocompatibility of BAG where high failure rate may be due to low sealing ability and marginal adaptation of BAG which allows bacterial leakage. This percentage was nearly agreement with the results of other studies [14,15]; In study of Jabbarifar., *et al*. [14] found that success rate was 70% of BAG after 3 months which may be due to dentine inductivity of BAG to form barrier against microbes. where failure rate was 30% in form a moderate inflammation which may be due to protection response from pulp to any foreign materials, he have shown that healing pulpal reactions are more dependent on the capacity of capping materials to prevent bacterial microleakage rather than the specific properties of the materials themselves. Haghgoo., *et al.* [15] they had reported 70% success rate which may be due to biocompatibility, osteoconductivity and antibacterial effect of BAG.

In the present study the success rate in $Ca(OH)_2$ group (C) was (80%) and this result may be due to its antimicrobial properties which are derived from the high PH which produces an environment that was not conductive for bacterial growth. These results in agreements with other studies [16,17]; In study of Yildiz., *et al.* [16] they concluded that clinical and radiographic success rate was (85%) in the $Ca(OH)_2$ group after 30 months and this may be due to bioactivity and biocompatibility of $Ca(OH)_2$. El Meligy., *et al.* [17] had reported that clinical and radiographic success rates of $Ca(OH)_2$ was 87% at 6 and 12 months postoperative evaluations and this may be due to high alkalinity ph that made it bacteriostatic agent and failure rate was 13% at the 12-month evaluation and this failure usually due to bacterial contamination through microleakage where $Ca(OH)_2$ have low sealing ability and through the poor dentine bridge at the pulpotomy site. This contains tunnels that may result in infection and necrosis of the pulp [18].

Conclusion

1. Biodentine proved better clinical and radiographic result as a pulp medicament than bioactive glass and calcium hydroxide, but this with insignificant difference.
2. BAG recorded good clinical and radiographic results as pulp capping medicament in treatment of vital young permanent teeth.
3. All three tested materials enhancing root formation "elongation" without significant difference, without any change in periodontal tissue.

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