

Effect of iRoot BP Plus on Pulpotomy of Young Permanent Teeth with Complicated Crown Fracture: A Case Report

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Abstract: Complicated crown fracture in young children is usually caused by injury. The primary goal of treatment is to maintain pulp vitality so that the root can develop normally. A newly developed bioactive ceramic called iRoot BP Plus has been demonstrated to have the ability to maintain pulp vitality and induce hard-tissue formation in pulpal tissue. In this case report, we preserved the pulp vitality of maxillary central incisor by iRoot BP Plus pulpotomy in a 10-year-old boy with complicated crown fracture. The pulp showed signs of vitality and there was no periapical radiolucency developed.

1 INTRODUCTION

There is a high incidence of dental trauma in children. The complicated crown fracture of young permanent teeth that characterized by enamel-dentin-pulp fracture is a relatively common kind of dental trauma (Rao, 2020). The root apical foramen of young permanent teeth has not been fully developed. The pulp is the main tissue to ensure the continuous development of root (Love R M, 1997). When the crown fractured and pulp exposed, it is particularly important to take active and effective methods to preserve the vitality of pulp. By preserving pulp vitality, apical development can be accomplished (Shabahang, 2020). The pulpotomy that the infected pulp tissue was removed and the healthy pulp was left is an effective treatment for the complicated crown fracture (Cvek, 1978). Materials such as calcium hydroxide (CH) and mineral trioxide aggregate (MTA) have been proven effective for pulpotomy, they are widely used in clinical (Parirokh, 2010; David, 2006). However, they also have their own shortcomings, such as low adhesion of calcium hydroxide and the discoloration of MTA over time (David, 2006).

iRoot BP Plus is a new type of bioceramic material which is convenient and ready-to-use. It can be used for pulpotomy because of its excellent biological activity, antibacterial properties, sealing ability as well as ability to promoting the formation of dentin bridge (Ibrahim, 2014). This case reports

iRoot BP Plus was applied for pulpotomy in young permanent teeth with complicated crown fracture.

2 CASE REPORT

A 10-year-old boy was referred to the Paediatric Stomatology Department of our University for the treatment of his traumatized maxillary anterior incisors because an accident that his teeth hit a swimming pool 16 hours earlier. The traumatized teeth had no history of treatment. A clinical examination found that the tooth 11 and 21 (Federation Dentaire Internationale, FDI) were fractured and the pulp was exposed. The teeth were active to the pulp electrical activity test. Radiographic examination showed that roots of tooth 11 and 21 were under developed with open apex, as is shown in Fig.1. The fractured teeth are treated with pulpotomy. They were isolated with rubber dam after local anesthesia. The infected pulp was removed while the healthy pulp was left. The pulp wound was rinsed with 5% sodium hypochlorite solution to remove debris. Compressed with sterile cotton ball for five minutes to stop bleeding. Subsequently, the remained pulp was covered with iRoot BP Plus (Innovative BioCeramix Inc, Canada). Then, the cavity was sealed with glass-ionomer cement (Ketac Molar Easymix, 3M ESPE, USA) and light-cured composite material (Filtek Z350 XT, 3M ESPE, USA), as is shown in Fig. 2.

The tooth of 11 and 21 were reviewed clinically and radiographically at 1 month,3month, 6 month and 12month during the first year. It means that an effective treatment has been achieved when the following conditions exist such as absence of clinical symptoms like pain and swelling, absence of radiographic pathology, presence of dentin bridges and signs of continued development of the root.

The re-examination results showed that tooth 11 and 21 had no obvious discomfort. Radiographic examination at 6 month showed that dentin bridge under iRoot BP Plus existed without any sign of pathology, as is shown in Fig.3a. In addition, the reviewed radiographic examination at 12 month showed that the roots walls thickened and the apical foramen tended to converge, as is shown in Fig. 3b.



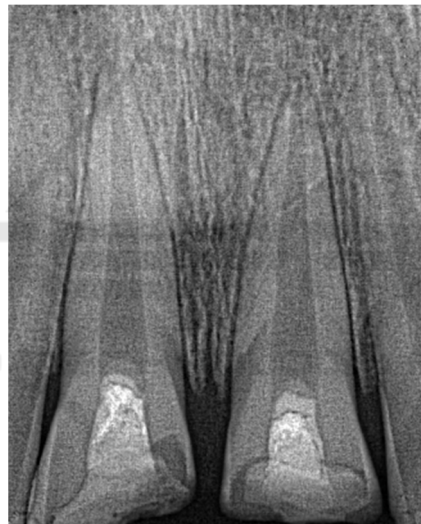
Figure 1: The preoperative periapical radiograph of tooth 11 and 21 with open apex.



Figure 2: The postoperative radiograph of tooth 11 and 21 with iRoot BP Plus pulpotomy.



(a) The reviewed radiograph at 6 month.



(b) The reviewed radiograph at 12 month.

Figure 3: The reviewed periapical radiograph of the case.

3 DISCUSSION

After the tooth eruption, the continued development of the root depends on the pulp. Immature permanent teeth with open apex have a rich blood supply, so they have strong anti-infection ability and repair ability (Andreasen, 2015).

When the crown is fractured and the pulp is exposed, the inflammatory reaction will spread to the apex with time (Olsburgh, 2010). So it is very important to choose suitable pulp capping agent to preserve pulp vitality. Pulp capping agent with good properties is indispensable to the success of

pulpotomy. The ideal pulp capping agent for pulpotomy should have anti-infective ability, good sealing properties as well as the ability to promote the formation of dentin from the remained pulp (David, 2006; Schwendicke, 2016). iRoot BP Plus is a type of newly developed premixed bioceramic material (Yang, 2020; Mahgoub, 2019). As a newly developed material, there are some studies on the properties of iRoot BP Plus. iRoot BP Plus have similar bioactivity and biocompatibility to MTA, which has been used for pulpotomy for a long time (Sanz, 2020). Moreover, iRoot BP Plus is insoluble in water and

easy to handle, it does not change color with time (Elshamy, 2016).

iRoot BP Plus has good antibacterial properties. Elshamy reported that the antimicrobial property of iRoot BP Plus comes from its high pH value (12.5). During the process of solidification, hydroxyl ions are released and penetrate into the dentin, raising the pH value of the surrounding environment, and then producing strong antibacterial activity against common pathogenic bacteria in infected root canal (Elshamy, 2016).

Besides, the reaction of iRoot BP Plus requires the participation of water, so a humid or bloody environment will not affect the curing of the material. It can be tightly bonded with the wall of the medullary cavity and will not be displaced by external force because of its good adhesiveness (Jitaru, 2016). In addition, the research also found that iRoot BP Plus can induce the proliferation of dental pulp cells and promote the formation of dentin bridge (Liu, 2015). In our case, the formation of the dentin bridge can also be radiographically observed under iRoot BP Plus. The thickened canal walls and progressively converged apical foramen on the periapical radiograph at 12 month indicated that the pulp is active and the root is continuing to develop. These properties possibly make iRoot BP Plus a ideal pulp capping material for pulpotomy treatment.

4 CONCLUSION

iRoot BP Plus could be a candidate material in the management of complicated crown fractures due to its good biological activity, antibacterial and adhesive properties. However, further research is necessary to clarify this conclusion.

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