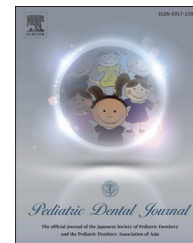


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Research Paper

Clinical and radiographic evaluation of four different zinc-oxide integrated root canal obturating materials used in primary teeth

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ABSTRACT

Aim: To compare and evaluate the clinical and radiographic success of four different zinc-oxide integrated root canal obturating materials.

Materials and method: 120 grossly decayed primary molars of children, aged 4 to 9 years were selected with signs or symptoms of irreversibly inflamed pulp tissue and randomly assigned to one of the four groups: zinc oxide eugenol, zinc oxide powder with 10% sodium fluoride, zinc oxide powder with *Aloe vera*, and Endoflas. Single sitting pulpectomy was carried out in all teeth and subsequently restored with a preformed crown in next sitting. Teeth were assessed clinically and radiographically for 3, 6, 9 and 12 months interval.

Results: 90 out of 120 treated molars completed 12-month evaluations. Overall clinical and radiographic success rates were highest for endoflas, followed by zinc oxide-sodium fluoride, zinc oxide-aloe vera and least for zinc oxide eugenol. However, no significant differences between success rates were observed amongst the four study groups ($P > 0.05$).
Conclusions: These results suggest that the sodium fluoride and aloe vera may be considered as suitable alternative root canal obturating materials for primary teeth with low cost to achieve acceptable therapeutic results.

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1. Introduction

The best space maintainer in both deciduous and mixed dentition is the deciduous tooth itself. Deciduous teeth also stimulate the development of the jaws and help in the masticatory process. Thus, preserving the integrity of deciduous dentition till they exfoliate themselves is important for the adequate development of permanent dentition [1].

The ultimate consequence of pulpally involved deciduous teeth if lost prematurely leads to the early loss of arch space [2]. Pulpectomy is thus, considered as the best option for the retention of deciduous teeth.

Materials used for filling of root canals in deciduous teeth should ideally possess the optimum requirement of being antibacterial, resorbable at the same rate as that of the tooth root, harmless to periapical tissues and be developing

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permanent tooth bud. In addition, they should easily fill the canals, adhere to the walls, do not shrink, easily resorb if passed beyond the apex, be easily removed if necessary, be radiopaque and cause no discoloration of the tooth [2–4]. The commonly used materials for deciduous root canal fillings are zinc oxide eugenol (ZnOE), iodoform based pastes and calcium hydroxide or various combinations of these materials.

Bonastre in 1837 discovered zinc oxide eugenol and subsequently, it was introduced in dentistry by Chrisholm in 1876 [1]. Its use as a root canal filling material was described by Sweet in 1930 and until 2008; American Academy of Pediatric Dentistry (AAPD) recommended it as the only material for obturation in deciduous teeth [1,5,6]. However, ZnOE has certain disadvantages like slow resorption, irritation to periapical tissues, necrosis of bone and cementum and alters the path of succedaneous tooth [7]. Walkhoff in 1928 introduced an iodoform based material for root canal therapy in deciduous teeth. They have been observed to possess better resorbability and disinfectant properties [3,6,8]. However, studies have shown that iodoform is irritating to periapical tissue and can cause cemental necrosis [9,10], in addition to causing discoloration of the teeth [9,11]. Allergic reactions to iodine in some individuals have also been reported [9].

Calcium hydroxide introduced in 1920 by Hermann has been used either as a sole root filling material for deciduous teeth or in association with iodoform like in vitapex and metapex but it resorbs earlier than the physiologic resorption of the root of deciduous teeth [12]. This creates a “hollow tube” effect wherein an unfilled root canal is permeated with tissue fluid that eventually becomes a site of infection [13,14].

Endoflas is another such material, comprises of triiodomethane, zinc oxide eugenol, calcium hydroxide, barium sulfate, and iodine dibutylorthocresol with a liquid containing eugenol and parachlorophenol. Thus, endoflas is the combination of zinc oxide eugenol, calcium hydroxide, and iodoform. This paste has the advantage of having the resorption limited to excess material, which has been extruded. Resorption does not occur within the canal. Thus, the material is neither resistant to resorption nor it results in hollow tube effect. It also has a broad antibacterial efficacy. It is hydrophilic and can be used in humid canals, also has the ability to disinfect dentinal tubules and hard to reach accessory canals that cannot be cleaned mechanically [13,15].

In order to overcome the disadvantages of ZnOE, iodoform and $\text{Ca}(\text{OH})_2$ at their different formulations, Chawla et al. in 2001 reported the use of a mixture of zinc oxide eugenol and calcium hydroxide as a root canal filling material in deciduous molars. This mixture, like $\text{Ca}(\text{OH})_2$, was also reported to resorb earlier than the physiologic resorption of the roots of the deciduous teeth. Since intracanal and the overpushed material gets resorbed, and that too at a faster rate than the physiologic root resorption, some authors felt that there was a need of adding a material which would result in delayed resorption thus matching the resorption rates of roots of deciduous teeth [9,16]. So, fluoride was added as it was thought that it would not only leach out which could be beneficial to the erupting tooth and may also result in a mixture which resorbs at the same rate as the tooth. Thus, Chawla et al., in 2008, studied a mixture of ZnO, $\text{Ca}(\text{OH})_2$ and fluoride in the form of 10% NaF. The resorption rate of the material was found to be similar to

that of the deciduous teeth. They then, concluded that this might have been due to the reaction of calcium hydroxide with fluoride resulting in the formation of calcium fluoride which not only induces radiopacity to the root canal filling material but also, matched the resorption rate of the roots of deciduous pulpctomized teeth [9].

Recently, a plant product “Aloe vera” has found to have applications in dentistry. Aloe vera is derived from the Arabic word “Alloeh” meaning “shining bitter substance”, while “vera” in Latin means “true” [17]. It is a plant from the Liliaceae family commonly known as “babosa”. After extraction of gel from its leaves, it has been therapeutically used as a healing and anti-inflammatory agent. Several studies with *Aloe vera* have demonstrated its positive qualities in relation to antimicrobial activity, the formation of mineralized barrier in pulp capping, antifungal activity [18].

In the past comparative studies have been conducted with zinc oxide eugenol, iodoform based paste, calcium hydroxide and endoflas [7,13,19]. However, the combination of zinc oxide-10% sodium fluoride without calcium hydroxide has never been tried to date. Also, there is only one study where the combination of zinc oxide and aloe vera was used as a root canal obturating material.¹Further, to the best of our knowledge, no study has ever been undertaken to compare these four novel obturating materials. Hence, the present study was planned to evaluate the clinical and radiographic efficiency of zinc oxide integrated four different obturating materials, viz, traditionally used zinc oxide-eugenol, zinc oxide powder-10% sodium fluoride, zinc oxide powder-Aloe vera, and zinc oxide powder-iodoform and calcium hydroxide-based paste (Endoflas) in root canal treatment of deciduous molars. The null hypothesis tested was that there would be no significant difference in the clinical/radiographic outcomes outcome of root canal treated primary molars with zinc oxide integrated four different root canal obturating materials. The need of the study was to establish the clinical and radiographic success of zinc oxide powder with aloe vera, zinc oxide powder with sodium fluoride, zinc oxide powder with eugenol and endoflas.

2. Methods

The present study was conducted in the Department of Pedodontics and Preventive Dentistry, ITS-CDSR, Muradnagar, Ghaziabad, India with prior approval from the ethical committee of the institute. All the guidelines of the committee are conversant with the guidelines required for conducting clinical trials in India safeguarding the rights, safety, and well-being of the subjects being further in accordance with the guidelines laid out in the World Medical Association Declaration of Helsinki.

The sample comprised 120 primary molars in 4–9 years old healthy children (Table 1). Signed informed consent was obtained from all the parents/guardians before the commencement of the procedure. The teeth having following signs and symptoms were included in the study: a history of spontaneous pain, tenderness on percussion, grossly decayed primary molars, the absence of fistula, evidence of radiolucency in the furcation or periapical areas and hemorrhage that cannot be controlled within 5 min

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