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OBTURATING MATERIAL IN PEDIATRIC DENTISTRY; A REVIEW OF LITERATURE

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ABSTRACT

A pulpectomy is a dental procedure that involves the complete removal of the dental pulp from a tooth's root canal system. This procedure is typically performed when the dental pulp, which consists of nerves, blood vessels, and connective tissue, becomes infected or inflamed due to extensive decay, trauma, or other dental issues. The success rate of pulpectomy is based on the obturating materials used to fill and in attaining a hermetic seal from the apical segment of the canal to the cavo-surface margin in order to prevent reinfection and root canals following procedures like pulpotomies and pulpectomies. The choice of obturating material in primary teeth is important as it should be biocompatible, promote healing, and prevent further infection .This article is a review of the commonly used obturating materials and their modifications as well as their advantages and disadvantages.

INTRODUCTION

Primary teeth are the best space maintainers and hence should be preserved and retained as long as possible. Pulpectomy is the procedure of extirpating the diseased pulp associated with microorganism and debris from the canal and obturating with an antibacterial resorbable filling material and it is indicated when the inflammation of the pulpal tissue involves the radicular pulp or when nonvital tooth is diagnosed. Ultimately, pulpectomy is needed to achieve good hermetic seal which depends on various factors such as good biomechanical preparation, types of obturating material used and achievement of minimum voids.[1]

Pulp therapy for pulpally involved primary teeth is a very challenging situation for clinicians due to: 1. Roots get resorbed physiologically.[2] In order to allow for the development of the succedaneous tooth, primary molar roots are usually curved, these curves increase the chance of perforation of the apical portion of the root or the coronal one-third of the canal into the furcation.[3]

Obturating the canal creates a fluid tight seal along the length of the root from the coronal opening to the apical system and eliminating all portals of entry between the periodontium and the root canal system.[4] primary objective is total elimination of microorganisms from the root canal & achieve a fluid tight seal at apical, lateral and coronal sections of root canal system.[5] Zinc oxide eugenol is most widely used obturation material; nonetheless, it has few drawbacks, such as, delayed resorption of extruded from the apex and concerns of toxicity. So, to overcome these, many obturation materials such as, calcium hydroxide and iodoform combinations (Metapex, Vitapex), endoflas and herbal derivatives have been introduced with promising results that can be used as advantage to traditional ZOE.[3]

Optimal requirements of obturating material for deciduous teeth

Rabinowitch stated, "The history of the treatment of root canals is the discussion of medication used.

- It should not irritate the periapical tissues nor coagulate any organic remnants inthe canal.
- It should not be soluble in water.
- It should not discolour the tooth.
- It should have a stable disinfecting power.
- Excess pressed beyond the apex should be resorbed easily.
- It should be inserted easily into the root canal and removed easily if necessary.
- It should adhere to the walls of the canal and should not shrink.
- It should be radiopaque.
- It should induce vital periapical tissue to seal the canal with calcified orconnective tissue.
- It should be harmless to the adjacent tooth germ.
- It should not set to a hard mass, which could deflect an erupting permanenttooth.[1]

Sundqvist and fidgor in 1998 assigned three primary functions to the root filling.

They are sealing against ingrowth of bacteria from oral cavity, entombment of remaining microorganisms,

complete obturation at a microscopic level to prevent stagnant fluid fromaccumulating and serving as nutrients for bacteria from any source.[4]

Rifkin identified criteria for an ideal obturating material used in pulpectomy that include

1) Resorbability
2) should have an Antiseptic property
3) Noninflammatory and nonirritating to the underlying permanent tooth germ,
4) Good Radiopacity for visualization on radiographs,
5) Ease of insertion, and Ease of removal.
6) Should not cause any tooth discoloration.

But till now none of the currently available obturating materials possess all of these criteria.[1]

HISTORY

Before 1800 root canal filling, when done, was limited to gold. Subsequent obturations with various metals, oxychloride of zinc, paraffin, and amalgam resulted in varying degrees of success and satisfaction. 1847, Hill developed the first gutta-percha root canal filling material known as "HILL'S STOPPING". Its a preparation of, bleached guttapercha and carbonate of lime and quartz, was patented in 1848 and introduced to dental profession. In 1867, Bowman made claim (before the st. Louis dental society) of the first use of guttapercha for canal filling in an extracted first molar. In 1883, Perry claimed that he had been using pointed gold wire, wrapped with some soft guttapercha. In 1887, the SS white company began to manufacture guttapercha points.In 1893, Rollins introduced a new type of guttapercha to which he added vermilion. The softening and dissolution of the guttapercha to serve as the cementing agent, through the use of rosins, was introduced by Callahan in 1914.[4]

In 1932 pulpectomy was advocated for the first time for retaining primary teeth which otherwise would be have been lost. The introduction of formaldehyde into endodontic therapy with Gysis triopaste, supporting the concept of fixing the pulp and leaving it sterile allowed possibility of pulp treatment in the primary teeth. However, it was Buckley in 1904, which used formaldehyde to treat pulp necrosis by introducing a formula containing 40% formaldehyde tricresol and glycerine. After Buckleys use of formaldehyde, pulp tissue removal was performed by root canal instrumentation and filling with resorbable paste.[3]

Various root canal obturating materials for primary teeth

- Zinc Oxide Eugenol
- Calcium Hydroxide
- Iodoform based pastes
- Walkhoff paste
- KRI paste
- Maisto paste
- Vitapex/Metapex
- Endoflas
- Endoflas-Chlorophenol-free (CF)
- Calen Paste
- Smartseal
- Guedes Pinto Paste
- Chirta HAP-Fil
- Pulpotec
- Aloe vera
- Ozone
- Rifocort
- CTZ Paste

Fig 1: Zinc oxide eugenol (ZOE)

Zinc oxide–eugenol cement

Zinc oxide eugenol was discovered by Bonastre (1837) and subsequently used in dentistry by Chisholm (1876). Sweet in 1930 said that it was the first root canal filling material to be recommended. ZOE is a commonly used filling material for primary teeth. Camp introduced the endodontic pressure syringe to overcome the problem of underfilling, a relatively common finding when thick mixes of ZOE are employed. Success rate with this material varied between 65% and 100%, with an average of 83%, and no significant difference could be observed when ZOE was compared with other calcium hydroxide and/or iodoform pastes.[3] Composition of zinc oxide eugenol is: Zinc oxide - 69.0%, White resin – 29.3%, Zinc acetate – 1.0%, ZincStearate – 0.7%, Liquid (eugenol-85%, olive oil-15%).[2]

Robin studied unresorbed zinc oxide Eugenol was surrounded by several layers of condensed cellular tissues which were composed of an inner layer of tightly packed cells and an outer layer of fibroblast with chronic inflammatory cells. Segmentation of mass occurs by ingrowth ofcollagen and fibroblast forming septa. Within the septa sequestration of zinc oxide is seen into smaller masses.[2]

ADVANTAGES OF ZINC OXIDE EUGENOL

Anti-inflammatory and analgesic properties, greater zone of bacterial inhibition, Radiopaque for good radiographic visibility, Easy to manipulate & fill in the canals, Insoluble in tissue fluids, Easily available, Cost effective and absence of tooth discolouration.

DISADVANTAGES

>alters the path of eruption of succedaneous teeth
> causes anterior crossbite, palatal eruption and ectopic eruption of succedaneous tooth,
>necrosis of cementum and bone,
>variation in resorption rate of ZOE or slow resorption in comparison to root resorption,
>enamel defects in permanent successors,
>failure of extruded material to resorb at the periapical region due to hardening,
>soft tissue irritation,
> allergy to eugenol and exhibits cytotoxicity and neurotoxicity.

To improve the properties and success rate of zinc oxide eugenol combination with different components were used like formocresol, formaldehyde and paraformaldehyde and cresol but the addition of these compounds neither elevated the success rate nor made the material more resorbable as compared to zinc oxide eugenol alone.

Table 1: Shows authors and their observation for zinc oxide eugenol.[1]

Authors	Observations
Allen[9]	Speculated that the resorption rate of zinc oxide eugenol (ZOE) and the root differed, resulting in small areas of ZOE paste possibly being retained
Barker and Lockett[10]	Material when extruded from the apex cause a mild foreign bodyreaction
Barker and Lockett[10] Spedding[26] Mortazavi andMesbahi[11]	Stated that extruded ZOE resisted resorption and took months or evenyears to resorb
Coll and Sadrian[12]	Pulpectomized teeth rarely exfoliate later than normal and timing of exfoliation was not related to retention of ZOE paste. Anterior cross-bite, palatal eruption, and ectopic eruption of the succedaneous tooth following ZOE pulpectomy
Coll et al.[13]	Reported that when ZOE extrudes, it develops a fibrous capsule that prevents resorption of the material. Thus, it has a slow rate of resorption and has a tendency to be retained even after tooth
	exfoliation. Areas of cementum resorption were evident, periodontal ligament exhibited intense and moderate thickening. Dentin resorptionwas not observed, whereas bone resorption was found.
Erasquin et al.[14]	Reported that the canals overfilled with (ZOE) are not recommended because it irritates the periapical tissues and causes necrosis of bone and cementum.
Flaitz et al.[15] Coll and Sadrian[22]	Observed deflection of permanent tooth eruption in 20% ofpulpectomized tooth that were extracted
Garcia-Godoy[16] Ranly and Garcia Godoy[23], Praveen et al.[24]	Reported deflection of developing permanent tooth bud because of itshardness
Hashieh et al.[17]	Studied the beneficial effects of eugenol. The amount of eugenol released in the periapical zone immediately after placement was 10-4 and falls to 10-6 after 24 hours, reaching zero after one month. Within these concentrations eugenol is said to have anti inflammatory
Holan and Fuks[18] ; Moskovitz andSamara[25]	Malformation of successor is attributed to the cytotoxic and neurotoxicnature of eugenol
Jerrell and Ronk[19]	Reported a case of developmental arrest of a premolar following overfilling of the root canal of the second primary molar using zinc oxide-eugenol/formocresol paste
Loevy[20]	Premolars erupt early after primary teeth pulpotomies. Possibly a mild chronic inflammation exists in periapical area of some pulpectomies judged successful that is not clinically evident. This could cause premature eruption of succedaneous tooth and uneven resorption of pulpectomy treated tooth
Praveen et al[24]; Sunitha et al[21]	Excess material forced through the apex during filling procedures can remain in the apical tissue during the process of physiological root resorption and it takes few months or even years to resorb

Table 2: Zinc Oxide combinations with other materials.

Combination	Authors	
Zinc oxide + Propolis (ZOP)	Al-Ostwani et al[29]	ZOP paste was synthesized by mixing 50% zinc oxide powder with 50% hydrolytic propolis. There wasacceptable clinical and radiographic success rate withfaster resorption seen in some cases.
Zinc oxide + Ozonated oil	Chandra et al.[30]	It has biological properties such as, bactericidal action, debriding effect, angiogenesisstimulation capacity and high oxidizing power (Guinesi etal., 2011). After 12 months followup there was progressive bone regenerationat the periapical region with good clinical andradiographic success rate.
Zinc oxide eugenol (ZOE)+ Calcium hydroxide(CA(OH)2 +Sodium fluoride	Chawla et al[31]	Ca(OH)2 - demerit of resorbing at a faster rate than the physiologic rootresorption. To overcome this filling material incorporated with fluoride was utilized. The addition of fluoride was seen to give this material aresorption rate that matchedthe resorption rate of primary teeth.
Iodoformized ZOE	Garcia-Godoy[16]	It was found to be effective for both aerobic and anaerobic bacteria with a maximum sustaining period of 10 days.
Zinc oxide + Calen past	Pinto et al.[32]	Clinical and radiograhic outcomes for calen/zo were equal to ZOE after 18 months, suggesting that both the materials can be indicated for obturation of primary teeth
Zinc oxidehydroxide+ Calcium	Praveen et al[24]	Obturated material remainedup to the apex of root canals till the beginning of physiologic root resorption and was found to resorb at thesame rate as that of primary teeth
Zinc oxide eugenol + Aldehydes	Praveen et al.[24]; Chawla et al.[31]	The addition of these compounds neither increased the success rate nor made the material more resorbable as compared to zinc oxide eugenol alone

CALCIUM HYDROXIDE

Calcium hydroxide was introduced by Herman.[3] Widely used as a liner for deep restorations, a temporary intracanal dressing and apexification procedures in permanent teeth. Calcium hydroxide is also recommended as a final obturation material for root canal therapy of primary teeth Calcium hydroxide paste used as root canal filling materials are calvital, calen paste, and L and C paste, seal apex. Main drawback of the material is that despite of its antiseptic and osteoconductive properties, it has the tendency to get depleted from the canals earlier than the physiologic root resorption.[2] Antibacterial effect is primarily due to the liberation of hydroxyl ions and inactivation of enzymes in the bacterial cytoplasmic membrane.[3] Calcium hydroxide is initially bactericidal then bacteriostatic, promotes healing and repair, has high alkaline pH that stimulates fibroblasts, stops internal resorption, and is inexpensive and easy to use. Carlos stated that in the interior of the root canal Calcium hydroxide pastes maintained a pH>12. This value of pH found on the external surface may be responsible for the temporary inactivation of the bacterial enzymes. The determining factor for the speed of action of Calcium hydroxide was investigated and found that the high concentration of hydroxyl ions inactivates bacterial enzyme of the cytoplasmic membrane, influences chemical transport and alters the availability of nutrients, thus causing a toxic effect on bacterial cells. This bacterial enzymatic inactivation is reflected in the growth, cellular division and metabolic activity that occur in the cytoplasmic membrane. The chemical disintegration of the membrane is related to the destruction of unsaturated fatty acids or phospholipids, due to a high concentration of hydroxyl ions that interferes with the lipidic peroxidation process and saponification reaction. Studies have reported a success rate of 80 to 90%.[2]

Calcium hydroxide when used as obturating material in hyperaemic pulp

Ca(OH)2 containing root canal filling materials when used in primary teeth with hyperemic pulp can come in contact with some vital pulp tissue remnants and can trigger the cascade ofinflammatory root resorption

Calcium hydroxide when used as obturating material in necrotic pulp

Ca(OH)2 paste produces superficial layer of necrosis causing damage to predentine which in turn can lead to exposure of dentine to odontoclasts and subsequent resorption.[3]

The main disadvantage of calcium hydroxide as a root canal filling material is that it tends to resorbs earlier than the physiological resorption of the root of primary teeth. This creates a "hollow tube" effect wherein tissue fluid seeps in and eventually becomes a site for infection. The other disadvantages include inadequate seal against microorganisms, dissolution under liquids and lack of adhesion to hard tissues and weak antimicrobial properties and aggressive internal resorption.[2]

Table 3: Showing antibacterial property of calcium hydroxide reported by various authors.[3]

Author	Observations
Abdulkader et al[27]	Calcium hydroxide associated with distilledwater, saline, glycerine was ineffective against several obligatory and facultativeanaerobic bacteria
Estrela et al[28]	Verified influence of antibacterial potential ofCa(OH)2 against Staphylococcus aureus, Enterococci faecalis, Pseudomonasaeruginosa, Bacillus subtilis, and Candida albicans and showed significant effectiveness for Ca(OH)2 paste or iodoform plus saline

VITAPEX/METAPEX

Kawakami et al introduced it in 1979.[4] Metapex (METABIOMED) and Vitapex (Neo Dental Chemical Products Co., Ltd, Tokyo, Japan) are available in preformed syringes, which is directly placed into the canals and the material is extruded by simple pressure. Metapex composed of iodoform - 40.4%, calcium hydroxide - 30.3%, silicone oil- 22.4% and others – 6.9. Addition of polysiloxane oil in Vitapex, enhances fluidity and permeability, which also improves the collateral benefit of root canal filling. The iodoform is a known bactericide that is released from the sealer and suppresses any residual bacteria in the canal or periapical region.[3]

Advantage

- Resorbability (When extruded from the apex of a primary tooth, vitapex can be resorbed as early as one week to three months, without causing a foreign body reaction. Its rate of resorption from within the canals is faster than physiological root resorption).
- easy delivery system,
- radio-opaque.
- does not set to a hard mass.
- It has bone regeneration potential and decreases abnormal tooth mobility and pre-existent bone radiolucency.

Pabla et al in 1999 evaluated the antimicrobial efficacy of zinc oxide eugenol, iodoform paste, KRI paste, Maisto paste and vitapex against intracanal microbes and found that Maisto paste had the best antibacterial activity. Iodoform paste was the second best followed by zinc oxide eugenol paste. Vitapex showed the least antibacterial activity.[5]

Mortazavi in 2004 found that vitapex was more effective than ZOE because it produced a greater decrease in abnormal tooth mobility and in pre-existent bone radiolucency.[3]

Saumyanavitet al in 2016 conducted a study to assess the antimicrobial efficacy of different obturating materials used in pediatric dentistry. Antimicrobial activity of obturating materials according to results obtained from the present study can be summarized as follows: endoflas> ZOE >calcium hydroxide + chlorhexidine> calcium hydroxide + iodoform +distilled water ~ metapex> saline.[4]

IODOFORM

It is a preparation of iodine obtained by action of chlorinated lime upon an alcoholic solution of potassium iodide when heated at 1040°F. No irritant action. Relieves pain and is a potent disinfectant. Better re-sorbability and disinfectant properties than ZOE. But they may produce a yellowish brown discoloration of the tooth. Erasquin in 1989 have shown that iodoform is irritating to the periapical tissues and can cause cemental necrosis. Iodoform containing root canal filling materials are available in different formulations such as KRI paste, maisto paste, guedes-pinto paste, rifocort, endoflas, vitapex.[1]

KRI Paste

KRI, basically an Iodoform paste, was introduced by Volkoff as a resorbable paste suitable for root canal filling. It consist of Iodoform (80.8%), camphor (4.86%), para chlorophenol (2.025%), Menthol (1.215%). KRI paste is a radiopaque endodontic root filling. Camphor and menthol are mixed with the antimicrobial agent and para chlorophenol, to minimize coagulation with adjacent tissues. Iodoform is added as a vehicle to carry the antimicrobial agent as it is a non-irritant and radiopaque.[5] According to Rifkin, it meets all criteria required from an ideal root canal filling material for primary teeth. It was also found to have long-lasting bactericidal potential. Overall success rate for KRl paste was 84% versus 65% for ZOE.

Kri-1: In 1989, a procedure was published for root canal preparation and filling in necrotic primary molars with a paste made of Kri-1 and pure calcium hydroxide obtaining a high percentage of success with remission of all symptoms. This was the first publication in which formaldehyde was mentioned as a component of root canal filling material, thus partly recovering Buckley'sformula, which contained 40% formaldehyde and glycerine.

KRI-3: This liquid differs from commonly used KRI-1 paste in that, its parachlorophenol, camphor and menthol concentration are twelve times superior and hence possess greater antimicrobial properties.[1]

Walkhoff Paste

Introduced by Walkhoff in 1928, it consists of iodoform, parachlorophenol 33-37% (disinfectant action depend on the liberation of the chlorine in the presence of phenol), Camphor – 63-67%and menthol. It can be used as intracanal dressing in cases of non- vital teeth

associated with large periapical lesions.[5]

MAISTO'S PASTE

Maisto introduced it in 1967. Tagger et al. used it as root canal filling material in primary teeth. It consists of zinc oxide -14 g, iodoform-42 g, thymol-2 g, chlorophenol camphor-3 cc, and lanolin – 0.5 g. Maisto's paste differs from KRI paste, in that it also contains zinc oxide, thymol and lanolin. This formulation change was made to reduce the resorption rate of the paste from within the canals of endodontically treated primary teeth. Eliyahu mass in 1989 found Maisto paste to be successful in infected posterior primary teeth and had positive healing effect on periradicular tissue. Pabla T et al (1997) evaluated the antimicrobial efficacy of Zinc Oxide Eugenol, Iodoform paste, KRI paste, Maisto paste and Vitapex against aerobic and anaerobic bacteria from infected nonvital primary anterior teeth. Order of antimicrobial activity: Maisto paste > Iodoform paste> Zinc Oxide Eugenol> Vitapex.[4]

GUEDES-PINTO PASTE

Guedes-pinto in 1981 proposed a root filling material for primary teeth named as guedespinto paste (GPP), Composed of rifocort, camphorated para chlorophenol and iodoform. The paste is made up of one equal part of each component, mixed on a sterilized glass plate.[4]

Advantages

- Easy to apply
- No toxic effects on permanent successor
- Radiopaque

Disadvantages

- Induces internal resorption in primary teeth
- Lack of adhesion to the hard tissue, leading to inadequate seal against microleakage.
- Can be depleted from canal.
- Resorbs earlier than the physiological resorption of the roots.[5]

ENDOFLAS

Endoflas is a resorbable paste produced containing components similar to that of Vitapex, withan addition of Zinc oxide eugenol. The powder contains triiodomethane and iodine dibutilorthocresol (40.6%), zinc oxide (56.5%), Calcium hydroxide (1.07%), Barium sulfate (1.63%) and with a liquid consisting of eugenol and Paramonochlorophenol.[2] The rationale behind incorporating three materials ZOE, Ca(OH)2 and iodoform into Endoflas was probably to compensate the disadvantages of one individual material with the advantages of the other.[5]

Endoflas has the advantage of having the resorption limited to excess material, which has been extruded periapically within 7 days. Resorption of material does not occur within the canal. Thus, the material is neither resistant to resorption nor does it result in hollow tube effect.[5] Fuks et al. observed that Endoflas resorbed when overextended periapically, However, it did not resorb intra radicularly and reported 70% success clinically with endoflas and a 100% decrease in periapical radiolucency. High clinical and radiographic success of Endoflas shows its excellent healing capabilities and complete bone healing. The high pH ensures powerful antibacterial effects that reduce periapical inflammatory processes and stimulate periapical healing with an increase of alkaline phosphatase action and periapical bone remineralization. The disadvantage of the material is its Eugenol content that can cause periapical irritation and can cause teeth discoloration.[2]

Navit S et al (2016) evaluated the antimicrobial efficacy of obturating materials against E. faecalis, amongst all the groups Endoflas had significantly higher zone of inhibition.

Advantages

- Hydrophilic and can be used in mildly humid canals.
- Firmly adheres to the surface of the root canals to provide a good seal.
- Disinfect dentinal tubules and difficult to reach accessory canals that cannot be disinfected or cleansed mechanically.
- Only resorbs when extruded extraradicularly, but does not wash out intra-radicularly.

Disadvantage

Eugenol content that can cause periapical irritation and can cause teeth discoloration.[5]

Endoflas-Chlorophenol-free (CF)

Following endodontic treatment of primary teeth radiolucent lesions were may be due to the filling material that contain phenol. Because of this, Endoflas CF was developed which is chlorophenol free. Chlorophenol was eliminated from endoflas as it has fixation effect which may affect the osteoblast cells.[5]

Calen Paste

It is a calcium hydroxide-based paste. Calen paste exhibits biocompatibility, high antimicrobial activity and satisfactory clinical, radiographic outcomes and intermediate setting time values.The mean initial pH was 6.1 and it exhibited a progressive increase until reaching a peak at the five-hour time point with mean ph value of 8.4. It has high registration levels, which indicate high radiopacity and lower solubility when compared with the other groups.[5]

Pinto DN et al (2011) compared success rate of ZOE and calen paste thickened with zinc oxide. High success rate with calen/zo was seen as this material prevented pathologic root resorption and induced new bone formation. ZnO provides better consistency to the paste.[4]

Aloe vera

Aloe vera is an herbal and naturally found material and its Properties made possible its wide usage in dentistry for various therapeutic properties. It enhances various phases of Wound healing process, such as macrophage recruitment, Collagen synthesis and wound contraction. Khairwa et al in 2014 evaluated clinical and radiographic success of zinc oxide Combined with aloe vera and showed good success rate. They reported that this material can be used as an alternative for Zinc oxide eugenol.[4]

PULPOTEC

It has antibacterial, antiseptic and anti-inflammatory properties. Iodoform is the main component and because of its antiseptic properties, it acts like an antibiotic paste at the entry of the empty root canal. It can be used in teeth with bone lesion and also help in reducing the infection clinically. Clinical and Radiolographical results show that this procedure could be considered as an alternative to the conventional endodontic treatment for the treatment of necrotic primary teeth in paediatric dentistry.[3] Aboujaoude S et al (2015) in their study evaluate the effectiveness of a Pulpotec modified endodontic approach on primary molars presenting necrotic pulp and furcation bone loss in a cohort of healthy children. In this study 67.7% of patients showed healing of bone loss, and a significant difference in height and width of the lesion was observed (respectively 80.6%, 71%.[5]

Ozone

Ozone is gaseous, energized form of oxygen. It is unstable and dissociates readily back into oxygen, thus liberating so called singlet oxygen, which is a strong oxidizing agent. They are responsible for remarkable bactericidal and fungicidal effects.[4] Chandra evaluated the success rate of the mixture of ozonated oil and Zinc oxide as primary teeth root filling material. The results of clinical and radiographic evaluation suggested that teeth obturated with ozonated oil-Zinc oxide demonstrated success rate (93.3%) when compared to Zinc oxide eugenol (63.3%). They concluded that Ozonated oil-ZnO demonstrated a good clinical and radiographic success at 12 months follow-up, hence can be considered as an alternative obturating material in infected primary teeth.[2]

Chitra HAP-Fil

Jeeva and Retnakumari et al. in 2014 observed the current trend in dentistry towards the use of biomaterials such as hydroxyapatite. In an attempt to find an appropriate root canal obturating material, they designed a new product named "chitra hap-fil".t is a hydroxyapatite nanoparticle gel based root filler material, which exactly corresponds to the mineral content of bone and dentine, deemed to be highly biocompatible. "Chitra hap-fil" apparently satisfies all requirements of an ideal pulpectomy material.[5]

This study was carried out to investigate the cellular and microbial response of Chitra HAP-Fil incomparison with Zinc oxide eugenol and Metapex by invitro methods.In Hydroxy apatite - Iodoform paste (Chitra HAP-Fil), The prime ingredient is hydroxyapatite nanoparticle gel (65%) which is the basic mineral content of human bone and pure Iodoform (32%) which imparts antibacterial property to the paste. The gelling agent (alginate) – 3% (including 0.2% surfactant) binds with the calcium ions in the hydroxyapatite. The study evaluated the cytotoxicity and antimicrobial activity of three pulpectomy materials, namely Zinc oxide eugenol, Chitra HAP-Fil and Metapex. The cellular response of three materials were evaluated and results showed that Metapex is significantly least cytotoxic than Chitra HAP Fil which is less cytotoxic than Zinc oxide eugenol.[2]

Smartseal

It is a root canal obturating material which is based on polymer technology. It uses a hydrophilic principle

which can absorb surrounding moisture and expand which results in filling of spaces and voids. Hydrophilic nature is revealed by ProPoints, which permits infinite water volume existing in the root canal system that is engrossed by these points. This water may hydrogen bond to the existing polar locations, therefore, permitting the enlargement inside the polymeric chain.[1]

Advantages

- Geometry of point can be accurately made
- Biocompatibility
- Controlled expansion.[5]

RIFOCORT

It is a product formed from a corticosteroid and an antibiotic, presenting a great antimicrobial action and recommended for the treatment of primary teeth presenting with pulpal infectious processes. The paste also presented bactericidal action against most organisms except for Enterococcus faecalis and Bacillus subtilis.[1]

CTZ Paste

CTZ is an antibiotic paste Comibation of chloramphenicol 500mg+tetracycline 500mg+zinc oxide 1000mg+ eugenol 1 drop.Chloramphenicol is an antimicrobial agent that acts against a large number of aerobic, facultative anaerobe and spirochetes as well as gram +ve and gram –ve microorganisms . Tetracycline is a broad spectrum antibiotic which can be bactericidal at high conc. offering excellent effectiveness against gram –ve bacteria and all anaerobes. ZOE provides analgesic properties and potent antibacterial action against staphylococcus, micrococci, bacillus and enterobacteria for more than 30 days.[1]

Advantages: • Simple and easy application • Antibacterial property • Stabilization of bone resorption • Does not cause tissue sensitivity • Does not produce damage to the permanent tooth in development.[5]

CONCLUSION

With adherence to sound principles in case selection and techniques, pediatric pulp therapy is a major health benefit to the child. It has been found that the current obturating materials for primary teeth while providing satisfactory clinical results still need to be modified to suit the various clinical situation that are encountered. The current combinations of calcium hydroxide and iodoform seem to provide better results than zinc oxide eugenol cements. Hence, researches have to be done further to develop a root canal filling material for primary teeth that meets all the essential needs of ideal obturating materials.

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