POSTS IN PRIMARY TEETH- A LITERATURE REVIEW

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SUMMARY:

Early childhood caries can lead to aesthetically unacceptable dentition with early loss of teeth which can affect a patient psychologically and socially. This trauma can be minimized by rehabilitation of grossly decayed primary anterior teeth with the use of intracanal retainers in the form of endodontic posts. Through this review the various options for retention of restorations in primary anterior teeth are described.

Key Words: Early childhood caries, Primary anterior teeth, Endodontic posts.

INTRODUCTION:

Dental caries is the most common dental disease affected in children and adolescents. According to the American Academy of Pediatric Dentistry, Early Childhood caries is defined "as the presence of one or more decayed, missing (due to caries), or filled tooth surfaces in any primary tooth in a child 71 months of age or younger".[1]

The clinical examinations of this disease have a distinctive pattern and the teeth mostly involved are maxillary central incisors, maxillary lateral incisors, and the maxillary and mandibular 1st primary molars. When children develop endodontic disease, the usual question is- Should these teeth be saved or extracted? In the last decade, the treatment option was limited to extraction of the affected teeth which results in loss of vertical dimension, reduced masticatory efficiency, development of parafunctional habits (tongue thrusting, speech problems), esthetic problems such as malocclusion and psychologic problems that can interfere in the personality and behavioral development of the child.[2]But nowadays, the concern has been shifted towards saving teeth rather than extraction.

Rehabilitation of primary anterior teeth in case of early childhood disease has been a challenge to the pedodontist. In the last few decades, the new materials like polycarbonate crowns, strip crowns, art glass crowns, veneered stainless steel crown etc were introduced which restore the carious teeth with sufficient tooth structure. But in cases where the teeth are severely damaged with loss of crown structure, these materials fail to withstand the occlusal forces.[3] Thus, post and core systems were introduced which provide retentive features for the successful completion of endodontic therapy.

RATIONALE FOR PRESERVATION OF PRIMARY TEETH[4]

Rationale for preserving primary teeth is mainly to maintain arch length, healthy oral environment, functions of chewing and speech, to improve appearance as well as for prevention and relief of pain.

POST AND CORE[4]

e post, the core and their luting or bonding agents together form a *foundation restoration* to support a coronal restoration for the endodontically treated tooth.

POST[4,5]

It is a restorative dental material that is placed in the root of a structurally damaged tooth in which additional retention is needed for the core and the coronal restoration. It is used when coronal structure is missing more than 2 proximal surfaces along with 1 axial wall. It is either cemented or threaded into a prepared channel to retain the restoration and to protect the remaining tooth structure. Posts transmit occlusal forces or masticatory forces favourably to the remaining root structure and periodontium.

Basic components are[2] (Fig 1):-

a. Residual coronal and radicular tooth structure supported by the periodontium.
b. The post: Located in the root and it retains the core.
c. The core: Located in the pulp camber and coronal area of the tooth and it replaces the missing crown structure.
d. Coronal restoration: Protects the tooth and restores function and esthetics.

All these components are joined together by the adhesive bonding agents or luting cements.

IDEAL PROPERTIES OF POSTS[4]:

An ideal post and core should be resorbable but it should provide adequate retention and resistance. Post should be well adapted to the inner dentinal wall as it is one of the governing factors for the retention of the restoration. The post should extend coronal from the root to anchor the core and subsequently the crown. It should provide pleasing esthetics where indicated. The post should be radiographically visible and it should be bio compatible.

INDICATION OF USING POST IN PRIMARY TEETH[5,6]

The main indication for using post is to re-establish shape and form of a severely decayed or fractured maxillary anterior teeth crown with half of crown structure lost or atleast 1mm of tooth structure remain supragingivally to provide support for final restoration.

PROBLEMS WHILE PLACEMENT OF POST IN PRIMARY TEETH[7,8]

The morphology and histology of primary teeth presents less surface area for bonding, relatively large pulp chamber and aprismatic enamel which is difficult to etch. Also the destruction of the tooth structure frequently involves the entire crown leaving just the root dentine for bonding of the restorative material and thus increasing the failure rate.

EXTENSION OF POST IN THE PRIMARY ROOT CANAL[9]

Innovations for short retentive posts are needed in primary dentition due to the physiological resorption that occurs in primary dentition, unlike the post and core used in adult dentition. Ideally, intra-canal placement of post in primary tooth is around 3mm that is the cervical one-third of the canal so it does not interfere with deciduous tooth root resorption and permanent tooth eruption.

SELECTION OF POSTS[9]

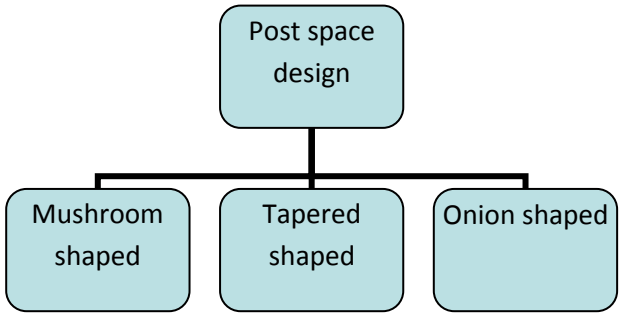
How well a specific post functions in the tooth reflects the stiffness/flexibility of the post, the amount of remaining tooth structure, the lateral forces the post and the fatigue strength of the post. Occlusal forces, bruxism, anterior guidance and sudden traumatic impact all affect the teeth and endodontic posts. Current post systems are designed to provide the best compromise between the desired properties and the inherent limitations of the available materials.

CLASSIFICATION OF POST USED IN PRIMARY TEETH: (Swara Shah et al 2016)[4]

Post which are used in primary teeth can be classified based on-

1. Based on types of post space design
2. Based on the material used
3. Based on post design
4. Based on fabrication
5. Based on retention

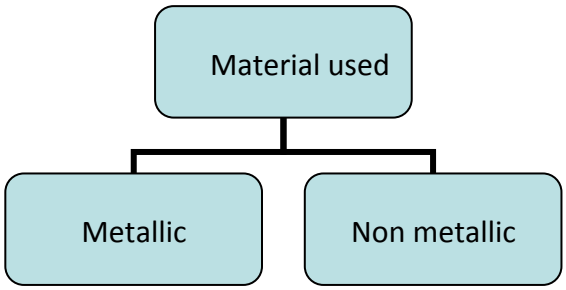
1. Based on Post Space Design



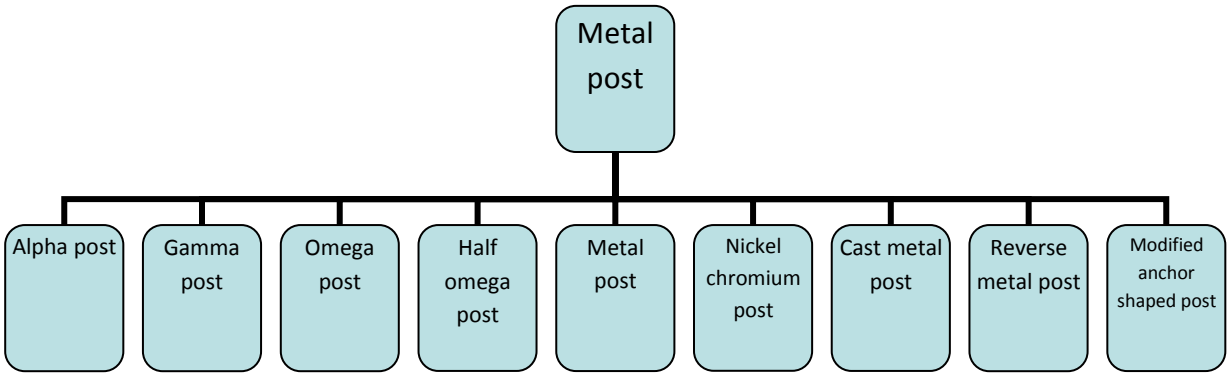
2. Based on material used-

a. Metallic

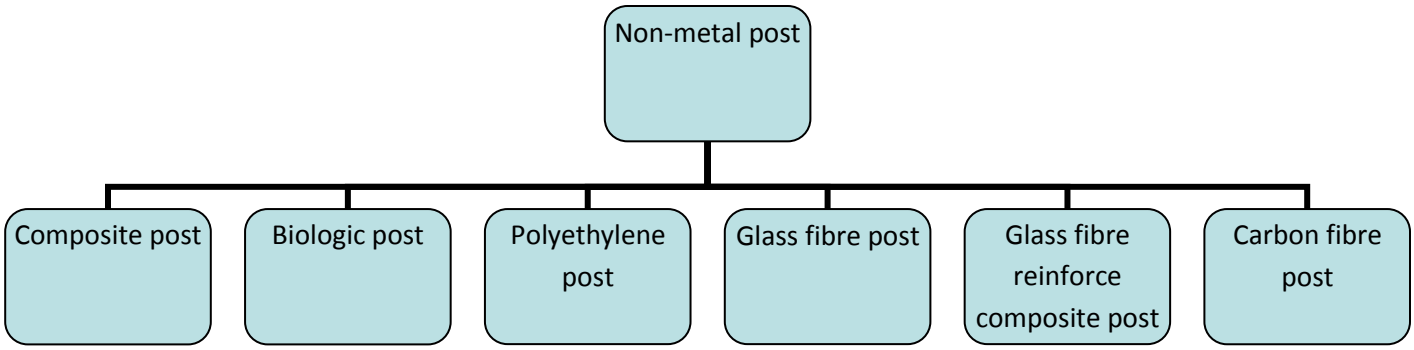
b. Non metallic



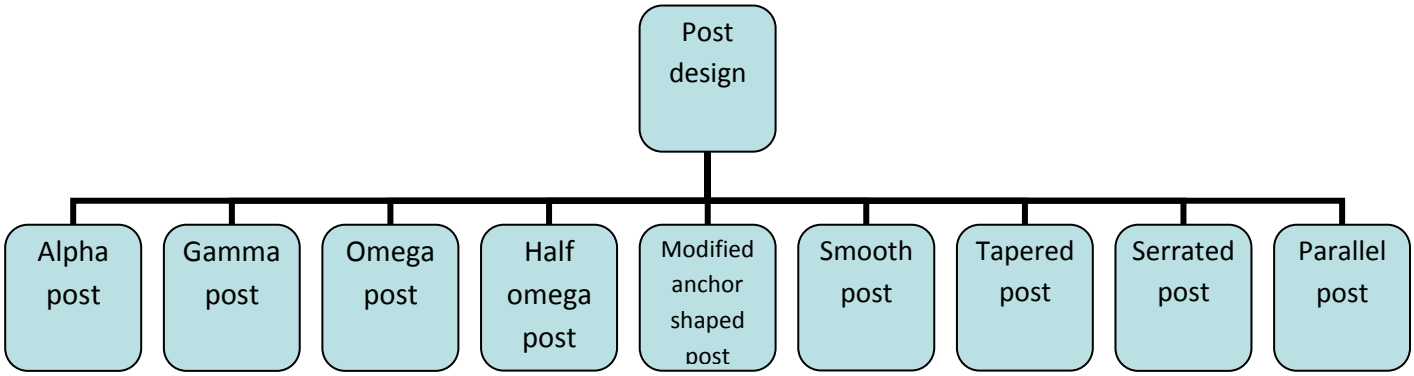
a.Metal post



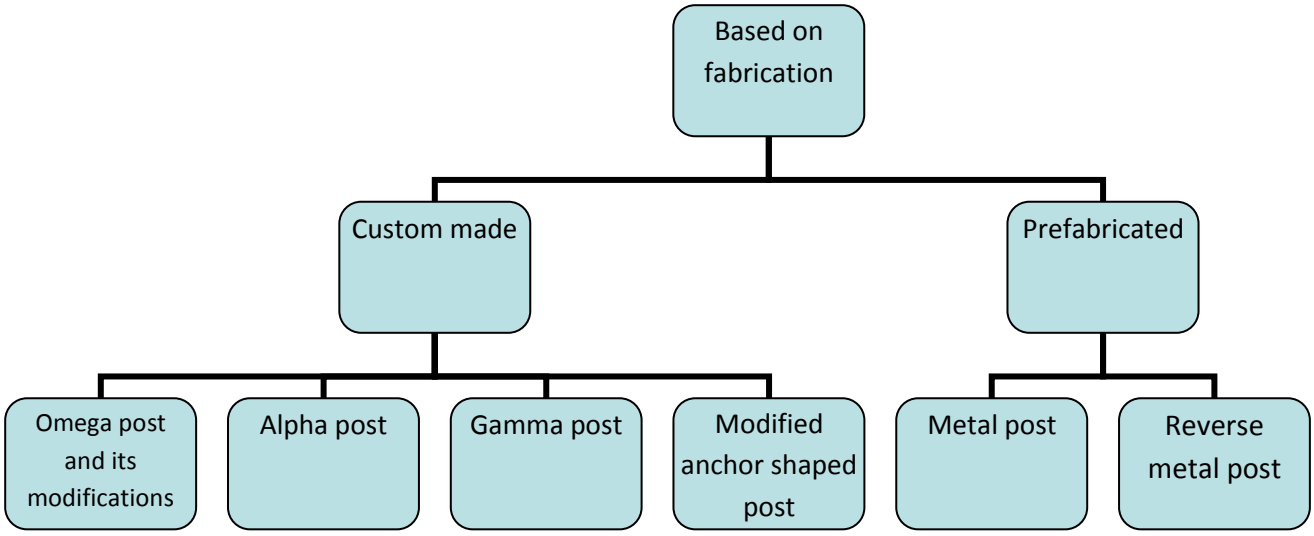
b.Non-metallic post



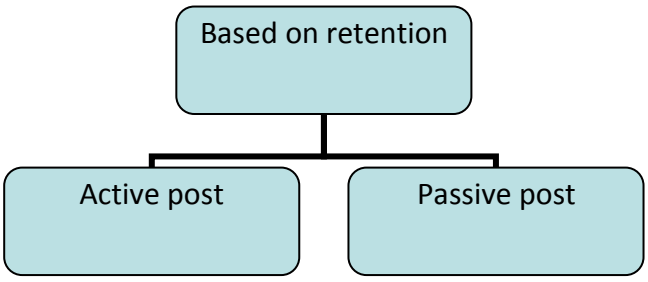
3. Based on post design



4.Based on fabrication



5.Based on retention (Fig 2)



TREATMENT PROCEDURE[8]

The main principles for preparation of a post and core includes preservation of all useful tooth structure, maintenance of apical seal and also stress should be minimized within the tooth as well as post and core.

Endodontic Treatment[7,8]:

Caries removal has to be done carefully being as conservative as possible, keeping intact hard dentin. Endodontic treatment of the retained root stumps has to be carried out using zinc oxide eugenol as the obturating material.

CREATING SPACE FOR POST[6]:

After completion of the pulpectomy to a suitable depth, a 4 mm length of the coronal portion of the root filling should be removed (2-3 mm below the CEJ). This could be done using a thin straight fissure bur with rubber stopper attached to a contra-angle handpiece. The diameter of the straight bur used should be less than the root canals. All visible ZnOE cement on the walls of the post space should be removed. The post-space has to be air dried & a 1 mm base of glass ionomer cement[10] or zinc polycarboxylate cement[1] should be placed to isolate the obturated material from the rest of post space. The rest 3 mm canal space is used for the placement of post.

POST INSERTION[6]

For each canal, a post of corresponding size is trial fit for proper fitting and proper length. The post has to be placed to a distance of 3 mm into the canal and the length to be adjusted, such that it extends 2 mm outside the canal. An intraoral radiograph should be taken to ensure that the end of the post is at the level of interdental crest or just apical to it. Any excessive length of the post is cut with a diamond bur under water coolant. The prepared post space should be then cleaned with saline, air- dried & acid – etched with 37% phosphoric acid for 15 seconds. This space should be rinsed and air dried with oil-free compressed air. A light cured bonding agent should be brushed on the etched surface & uniformly dispersed by a compressed air blast. It has to then be light cured for 20 seconds. The tip of flowable composites tube should be placed 2 to 3 mm below the CEJ and the composite is injected. The post is then inserted into the canal with cotton pliers. It is then light cured according to the manufacturer's instructions.

POSTS USED IN PRIMARY TEETH :

OMEGA POST[9] (Fig 3):

The use of Omega loop is introduced by Mortada and King in the year 2004.[7] A custom-made "omega wire extension" is placed in the space of the pulp chamber and entrance of the root canal with the projecting portion of the loop being used for retention of the coronal restoration.

Construction of omega post:

Omega post is made from 1.5cm length of 0.5mm round orthodontic stainless steel wire. The pulpal ends extended approximately 3mm into the root canal so as to increase the overall retention of the wire. The incisal end or loop of the wire projected 2-3mm above the remaining root structure. This provided better mechanical retention and support for the restorative material.

Advantages:[10]

It is a quick process. Wire does not cause any internal stresses in the root canal as it is incorporated in the restorative material. It can be done with minimal chair side time. Coronal extension provides retention to coronal

restoration. And main it is easier, simpler and inexpensive treatment.

Disadvantages:
Disadvantages of this processes are that the adhesion between omega wire and dentinal wall is mechanical. The wire adaptation to the internal walls is inadequate which may lead to dislodgement of the wire, excessive masticatory forces may lead to radicular fracture; also the retention of omega loop is less compared to GFRC (Glass Fibre Reinforced Composite).

HALF OMEGA POST(Fig 4):[11]

Stainless steel wire is bent to half omega shaped to make the post. Serrations are added to increase the potential surface area for attachment of the restorative material and consequently increase the long-term stability of an esthetic restoration.

Construction of half omega post:
A 0.7 mm stainless steel orthodontic wire has to bend into half omega shape to hold restorative material for core build. Serrations should be made on the stainless steel wire to get better mechanical retention. The incisal end of the loop of the wire should project 2 to 3 mm above the remaining root structure.

Advantages:
This procedure is easier, simpler, inexpensive as well as less time consuming.

Disadvantages
It is direct adhesive restorative procedure which does not always have satisfactory result because of small surface of bonding and aprismatic nature of enamel that is difficult to etch. The wire does not adapt adequately to the canal because it is not the exact copy of the canal which may lead to radicular fracture as a result of excessive masticatory forces.

ALPHA POST[12]

Stainless steel wire is bent into Alpha shaped and placed in the canal and here also the extension of the post in the canal should not be more than 3mm.

GAMMA POST[13]

0.6-mm orthodontic wire is bent to form the Greek letter "y". The loop portion is placed inside the post space, and the 2 free ends are placed toward the coronal portion and help to provide retention to coronal restoration.

MODIFIED ANCHOR SHAPED POST(fig 5):[3]

It is introduced to overcome the retentive problems of omega posts. A 19-gauge orthodontic wire, 1.5 inch in length, is bent using a universal plier. For post fabrication one of the arms of wire is bent downwards and turned to the opposite side. The same procedure is repeated for the other arm. The free end of the arms is bent towards the curved end. The excess wire is cut as required. On compressing the curved end, the free end opens up to adapt to the walls of the root thereby giving extra mechanical retention. Excess compression is not advised as it may cause root fracture. The post is placed in the prepared root canal and checked for adaptation. Mushroom shaped retention grooves are placed on the inner side of the root to create locking mechanism thereby increasing retention.

Advantages:
It is a simpler, easier and inexpensive technique**.** Apart from this, the free end provides extra retention by adapting to the inner wall of the root also the curved end provides strength to the coronal structure.

Disadvantages:
The adhesion between modified anchor shaped post and dentinal wall is mechanical.

NICKEL CHROMIUM POST WITH MACRORETENTIVE ELEMENT[6]

Rodrigues Filho and co-workers (1995) described the use of nickel-chromium (Ni-Cr) cast posts with macroretentive elements. Such posts varied from 1.5 to 3.0 mm in diameter. For cementation of this post dual-cured adhesive or resin composite is used. The objective of this technique is to increase the resistance of the restored teeth to mechanical loading by bonding the intra canal retainer. The round macroretentive elements in Ni-Cr cast posts offer better distribution of masticatory loading forces. The possibility of chemical/mechanical adhesion by using adhesive systems allows for the integration of restorations to the dental structure. These posts are indicated for the reinforcement of enlarged canals, considering that limited amounts of dentin tissue are available, which is a common situation during restoration of primary anterior teeth. They are prefabricated in several diameters and therefore can be readily used.

Advantages:

This post is useful for reinforcement of primary teeth with wide canals and little remaining dentin.

Disadvantages:

This post system is expensive**;** as it requires an additional laboratory stage and also could pose problems during natural tooth exfoliation.

CAST METAL POSTS(Fig 6)[14]

They are fabricated using indirect method of fabrication. They have disadvantages includes higher cost and requires an additional laboratory stage for preparation of post and they could pose problems during the natural tooth exfoliation.

REVERSE METAL POST (Fig 7)[15]

Short prefabricated metal post is used as reverse metal post. The post is inserted upside down so that the 3-mm head into the canal and the remaining 5 mm of the threaded section is positioned out of the canal as a core for coronal restoration. Bevelling should be done to reduce the stress concentrated at the dentinal walls and then the head of the post is try-fitted with the coronal 3 mm of the canal. 3 mm of the coronal part of the canal is prepared for future replacement of post. Canal is prepared almost rectangular with semi-rounded line angles in order to match with the quadrangle core of a prefabricated metal post that is planned to be placed reversely into the prepared canal. Core length of prefabricated metal posts is 3mm.

Advantages

This procedure is easy-to-perform, provides adequate retention and good esthetic. It can be performed directly in the mouth and also can be completed in one appointment.

Disadvantages

There are more possibilities of cracked root subsequent to long-term function, especially in children with heavy occlusion or parafunctional habits.

GLASS IONOMER SHORT POST[16]

Carranza F, Garcia GF in 1999 has used glass ionomer cement directly as post in primary anterior teeth to increase the retention of coronal restoration.

COMPOSITE POSTS

Composite short post[17,18]

The composite resin short post and crown was developed for the restoration of severely decayed primary anterior teeth. Its development began in 1981 and the technique was first reported in 1986. The use of resin based composite post reinforced with metallic pins was suggested and a technique referred to as "short post" technique was proposed. Advantage of this post is that it provides satisfactory esthetics whereas loss of retention owing to polymerization contraction is the main disadvantage.

FIBRE BASED POST:[19,20]

Types:

- Polyethylene fibre post(Ribbond)
- Glass fibre post
- Glass fibre reinforced composite resin Post (GFRP)
- Carbon fibre post

Advantages

These fibre posts have high tensile strength, increased fatigue resistance and inherent rigidity. These posts have good resistance to corrosion, they are biocompatible to different core materials also possess good chemical bonding to Bis-GMA resins. A young modulus of elasticity of this group of posts is approaching that of dentin.

Disadvantages:

But the cost of this posts when considered for pediatric group is excessive. Also this procedure is technique sensitive as well as time consumption due to multiple steps.

1. Polyethelene fibre(Ribbond)(Fig 8): [21]

Polyethylene fibre is a recently developed material reported to have a clinical advantage over traditional post and core material. These fibres improve the impact strength, modulus of elasticity and flexural strength of composite materials. When compared to other fibres, they are almost invisible in the resinous matrix. Due to these reasons, they are the most appropriate and the best esthetic strengtheners of composite materials. In constructing the short posts, Ribbond was placed only in the cervical one-third of the canals to avoid interference with the process of permanent tooth eruption. This combined technique of polyethylene fibres and composite resin provides excellent functional and esthetic results. Elasticity of this is closure to dentin. This post is esthetically good and also simple to use. But disadvantages include flexural strength which is less than glass fibre reinforced composite post. These posts are expensive as well as technique sensitive.

2. Glass fibre post[22]

They are composed of unidirectional glass fibres embedded in resin matrix. They have advantage of stress distribution over broad surface area and they are increasing the load threshold. Disadvantage of this post system are failure to stick to the resinous matrix which interferes with the esthetics and interfere with resorption if extended beyond 3 mm.

3. Glass fibre reinforced composite resin posts(Fig9)[23]

Glass fibre-reinforced composite resin posts (GFRC) are new and have been used as an alternative to the other post systems. The properties of fibre- reinforced posts are dependent on the nature of the matrix, fibres, interface strength and geometry of reinforcement. FRC posts contain a high volume percentage of continuous reinforcing glass fibres embedded in a polymer matrix, which holds the fibres together. The matrix commonly comprises epoxy or acrylic polymers with or without filler materials. The fibres used in FRC posts may be classified according to fibre direction—

- unidirectional
- bi-directional
- Whether they are pre-impregnated with unfilled resin or filled resin

Advantages:

This post possesses greater flexural strength (1280 MPa) over 650 MPa of the older fibers. This fibers do not fray; hence they are ease of handling. In this fibers are arranged parallel in a unique interpenetrating polymer matrix (IPN) and hence can be used in high stress bearing areas. They can bond to any type of composites and also fibre surfaces can be re- activated

4. Carbon fibre post:[24]

It is non-metallic prefabricated post systems. Carbon fiber based posts are essentially

composite materials. They are made of equally stretched and continuous aligned unidirectional carbon fibers, 8mm in diameter, embedded in an epoxy resin matrix. The carbon fiber post is a passive post, which is black in colour. They are available in different sizes (from 1 to 1.7mm) and shapes (parallel sided, tapered, smooth and serrated forms). It is made of zirconium oxide ceramic. Yttrium oxide is added as a stabilizing agent. Ceramic post has a cylindro-conical design, where the post tapers in its apical third in order to preserve tooth structure and to facilitate cementation. This post system prevents fatigue fracture also strengthen composite materials but they have dark colour so esthetically are not good.

BIOLOGIC POST(Fig 10)[25,26]

The concept of attaching the natural tooth fragments began when Chosak and Eidelman in 1964 used a cast post and conventional cement to reattach an anterior crown segment. The term 'Biological restoration' was introduced by SANTOS & BIANCHI in 1991; it is an alternative technique that uses adhesive capabilities of materials in combination with strategic placement of parts of extracted human teeth to achieve better esthetics and more conservation of sound dental tissue. Regarding primary teeth, Tavares et al(1992) were the first authors to describe a case in which tooth fragments were used to restore carious primary posterior teeth. Conventionally, this technique consists of bonding sterile dental fragments to teeth with large coronal destruction. Ramires-Romitoet al (2000),used teeth from the Human Tooth Bank of Sao Paulo University Dental School to be used as natural posts and crowns to fit into the roots and replace the crowns as well.

The biological post and crown restoration is less expensive and represents a feasible option for strengthening the root canal, as it preserves the internal dentine wall of root canal, providing greater tooth strength and retention. It has some drawbacks like need for the tooth bank, agreement by donor and recipient of tooth fragment.

LUTING AGENTS

Many luting agents can be used for the cementation of post in primary canal. The selection of luting agents mainly depends on the type and material of the post being used. (Table no. 1).

CORONAL RESTORATIONS AFTER POST PLACEMENT[20]:

Remaining coronal structure can be restored with direct or indirect technique or with single tooth prosthesis like-

- Strip crowns
- Stainless steel crowns
- Porcelain veneers
- Polycarbonate crowns
- Acrylic resin crowns

CONCLUSION:

Dental caries, although not life threatening but causes physical as well as psychological discomfort to pediatric patient. Through this review, the various posts are described for rehabilitation of grossly mutilated primary anterior teeth in children. Each endodontic post carries its own advantages and disadvantages. The selection of a particular procedure depends on the clinician's preferences and patient requirements.

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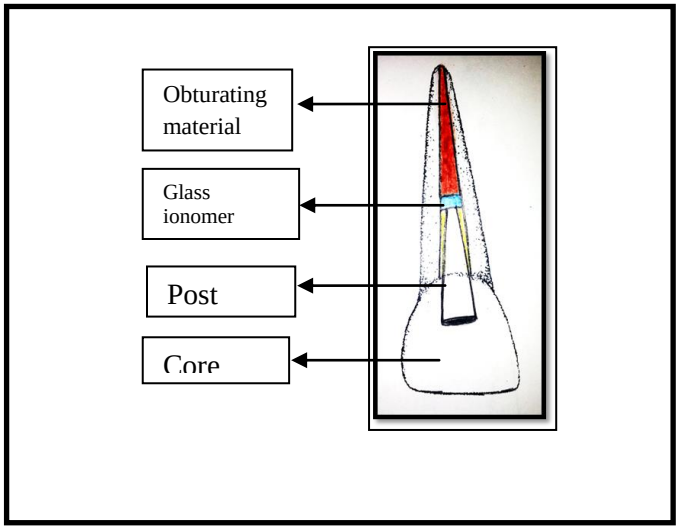
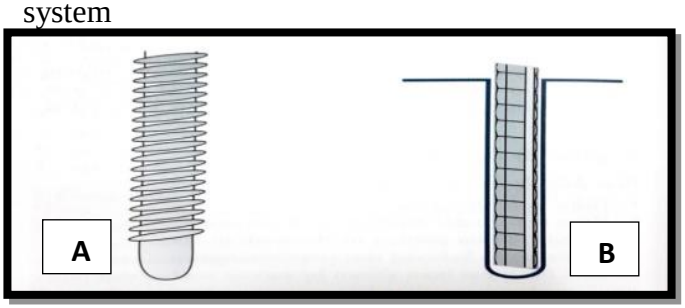


Fig 1: Basic components of post and core system



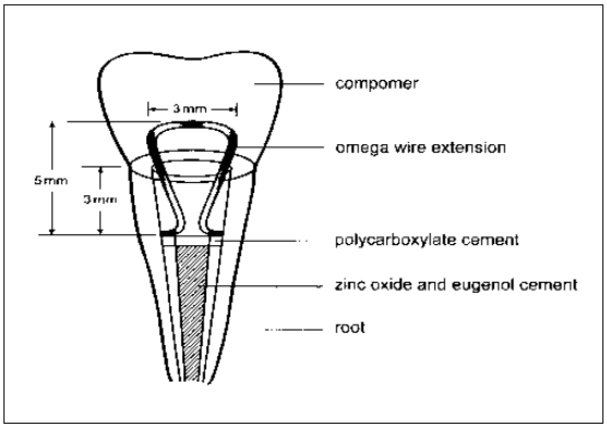


Fig 3: omega loop extension

Fig 4: Half Omega Post

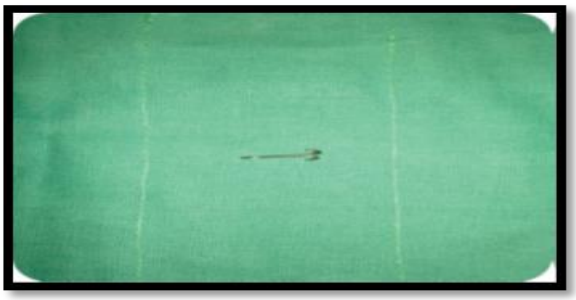


Fig 5: modified anchor shaped post

Fig 6: Cast metal post

Fig 7: Reverse metal post

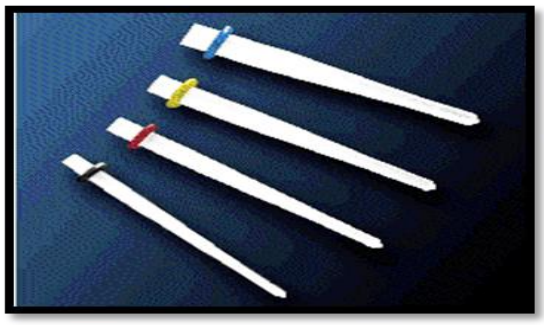


Fig 9: Glass fibre reinforced composite post

Fig 8: Polyethelene fibre post

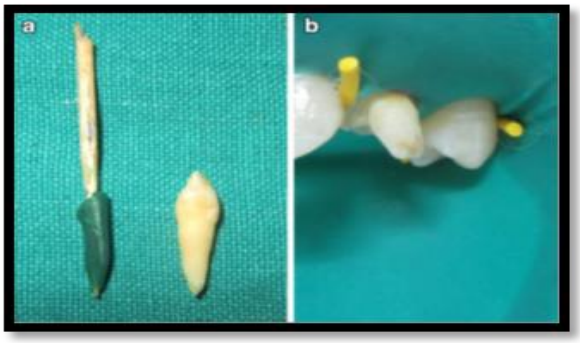


Fig 10: Biologic post

Post	Luting agent	Suggested by
Ni-Cr post with macroretentive element	Dual cure resin	Wanderley MT (1999)[6]
Gamma post	Flowable composite	Kumar R Gajjar (2010)[13]
Half omega post		Shrinivasan CH (2011)[11]
Glass Fibre Reinforced Composite post		Yusuf K (2011)
Glass fibre post		Mehra M (2012)[22]
Omega (Metal post)	Glass ionomer cement	Ganesh R et al (2012)
Reverse metal post	Zinc phosphate cement	Eshghi A, Esfahan RK, Khoroushi M (2011, 2014)[15]

Table 1: luting agent

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