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Review

A paradigm of esthetic post and core in primary dentition - A review

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Abstract

Early childhood caries or trauma to anterior primary teeth leads to improper functioning, speech difficulties and poor esthetics. A complete treatment of primary anteriors requires pulpectomy and restoration. To conserve functional and esthetic harmony such patients require post and core systems. This article describes about different posts which can be used in primary dentition which helps in coronal restoration by providing adequate retention. This review article includes a literature search of different articles from various journals about early childhood caries, post and core system, primary teeth restoration. Search includes the case reports, literature reviews, systemic review which used post and core management of primary anterior teeth. In the search, there were no filters activated and no language restrictions. Included references assessed the use of post and cores used in pediatric dentistry (12 in vivo, 6 reviews, 3 in vitro studies), and the articles were reviewed by two reviewers (both part of the authorship team). Management of early childhood caries and trauma in primary anterior teeth in which crown structure had been lost can be restored by different post and core to conserve functional, biological and esthetic harmony of teeth. Preformed posts and customized posts, both can be used in restoring the crown structure of primary anteriors for preservation of esthetics and function. Glass fibre, ribbond posts and glass fibre reinforced posts add more esthetic value than metal posts.

Keywords: *esthetics, post and core, pulpectomy, restoration*

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Introduction

Esthetics is one of the prime concerns in today's practice. Pleasant appearance of anterior teeth is the demand of children and parents. A good looking face is a letter of recommendation. From years it has been conceptualized that the first impact a person makes is because of his pulchritudinous appearance which lasts for long time. The judgments, an individual makes concerning the personal characteristics of others, can be affected by dental appearance.[1] Nowadays the esthetics is a matter of concern for children also.

In children the deterioration of primary teeth mainly occurs either because of early childhood caries or trauma. According to AAPD, "ECC is defined as "the presence of one or more decayed (noncavitated or cavitated lesions),

missing (due to caries), or filled tooth surfaces in any primary tooth"5 in a child under the age of six. The definition of severe early childhood caries any sign of smooth-surface caries in a child younger than three years of age, from ages three through five, one or more cavitated, missing (due to caries), or filled smooth surfaces in primary maxillary anterior teeth, or a decayed, missing, or filled score of greater than or equal to four (age three), greater than or equal to five (age four), or greater than or equal to six (age five)."[2]

Maxillary incisors are the most affected teeth in ECC. Complete crown destruction occurs in severe cases of ECC. Accidental falls, road traffic accidents, and various sports activities have been reported as the most frequent causes of traumatic dental injuries in children. These oral injuries results in esthetic, psychosocial, functional, therapeutic problems and may even lead to irreversible damage to dentition and supporting structure.[2]

Severely decayed or fractured primary teeth require complete treatment with appropriate restorations to maintain the functional and esthetic harmony. Formerly, the treatment of the severely damaged primary anterior teeth was based on the removal of these teeth. However it leads to critical consequences with loss of vertical dimension of occlusion, space issues for permanent dentition, oral habits and esthetics.

In contrast, extensive restorative treatments of anterior primary teeth have always been a big challenge in pediatric dentistry. The restoration of these teeth is difficult due to the small size of the crown, relatively large pulp chamber and the age of the child.

In addition to preserving the tooth structure and reconstructing the primary form, considering the beauty and use of composite resins are highly regarded in anterior teeth. Meanwhile, the use of composite restorations for primary teeth harbors some problems due to structural differences between primary and permanent teeth such as less available dentin for bonding. In severe decayed incisors where pulpectomy is carried out, intracanal retention is necessary for durability of the composite crown.

crown.

In the last few decades of the advent of new materials like strip crowns, polycarbonate crowns, veneered stainless crowns and art glass crowns, carious teeth with sufficient tooth structure are being restored esthetically and effectively. This has led to a gradual shift from extraction to non extraction treatment modalities. But these materials fail to withstand occlusal forces in severely damaged teeth with loss of crown structure. Hence post and core systems were introduced to provide additional support to the restorations.[2]

A post and core is a typical type of restoration which is carried out on the teeth in which crown structure has been lost due to severe caries or trauma. A post is a material which is inserted to a certain depth into the root canal to provide strength and then core is build up with a restorative material.

Maintaining primary teeth is crucial for the overall health and development of children. When primary teeth are damaged due to decay or trauma, restoring them with post and core is a common treatment option. However, selecting the ideal post and core material for primary teeth can be challenging. The material should be resorbable, provide adequate retention and resistance, and not cause radicular fracture or secondary infection. In recent years, the use of root stumps of primary teeth as a post and core material has been gaining attention.

This article will provide an overview of the use of root stumps of primary teeth as a post and core material, including its benefits, limitations, and clinical applications. Additionally, this article will review the past and present of post and core materials for primary teeth, including the advantages and disadvantages of different materials. By understanding the various options available for post and core materials, dental professionals can make informed decisions to provide the best possible care for their young patients.

Rationale for preservation of primary teeth

Primary teeth maintains the arch integrity, space management for erupting permanent teeth and definitely the esthetics. Rationale for preserving primary teeth is mainly to maintain arch length to preserve the space for permanent teeth, maintaining healthy oral environment, functions of mastication and speech and to enhance the smile of the patient by securing esthetics.[15]

History

Study	Author
Technique of "mushroom shaped" composite resin short post and a composite resin crown was built on the reinforced superstructure of the remaining crown dentin.[3]	Peter L. Judd et al; 1990
Mini pins as post in primary anteriors.[4]	Carranza F et al; 1999
Fibre core post system in carious primary anterior teeth.[5]	Sharaf AA; 2002
Technique involved placement of an omega shaped stainless steel wire extension into the entrance of the root canal.[6]	Mortada A et al; 2004
Compared the fracture resistance of two different types of polyethylene fibers. Pre-impregnated fibers with resin and non pre-impregnated fibers.[7]	Island G et al; 2005
Compared glass fibre reinforced composite resin as post with omega shaped stainless steel wire post in primary maxillary anteriors.[8]	Priya Subramaniam et al 2008
Modified omega loop technique for the restoration of the severely damaged primary anterior teeth.[9]	Aminabadi NA et al 2009
Modified anchor shaped wire as a post in severely decayed primary anteriors.[11]	R. Rajesh et al; 2014
Compared four post systems in primary teeth : Intact glass fiber posts, split-ended glass fiber posts, composite resin posts, and orthodontic γ "gamma" wire posts.[12]	A.Baghalian et al; 2014
Compared Customized quartz fiber post, Composite post and Prefabricated glass fiber post restoration in extracted primary teeth for fracture resistance.[10]	Seraj B et al; 2015
Used root stumps of primary tooth as a post and core in restoring primary anterior teeth.[13]	Ravi R et al; 2020
In-vitro comparison of reverse-oriented metal post with fiber post was carried out on primary incisors.[14]	Barghi H et al; 2023

Classification of post systems[16]

Based of fabrication (fig—1,2)

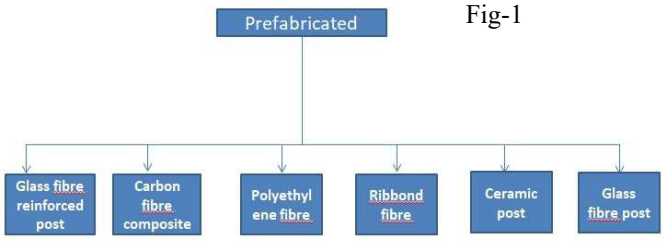


Fig-1

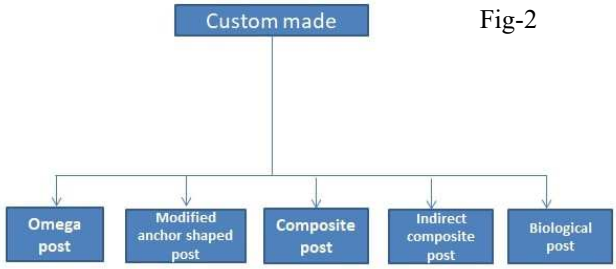


Fig-2

Different post systems used in primary dentition

1. Composite post

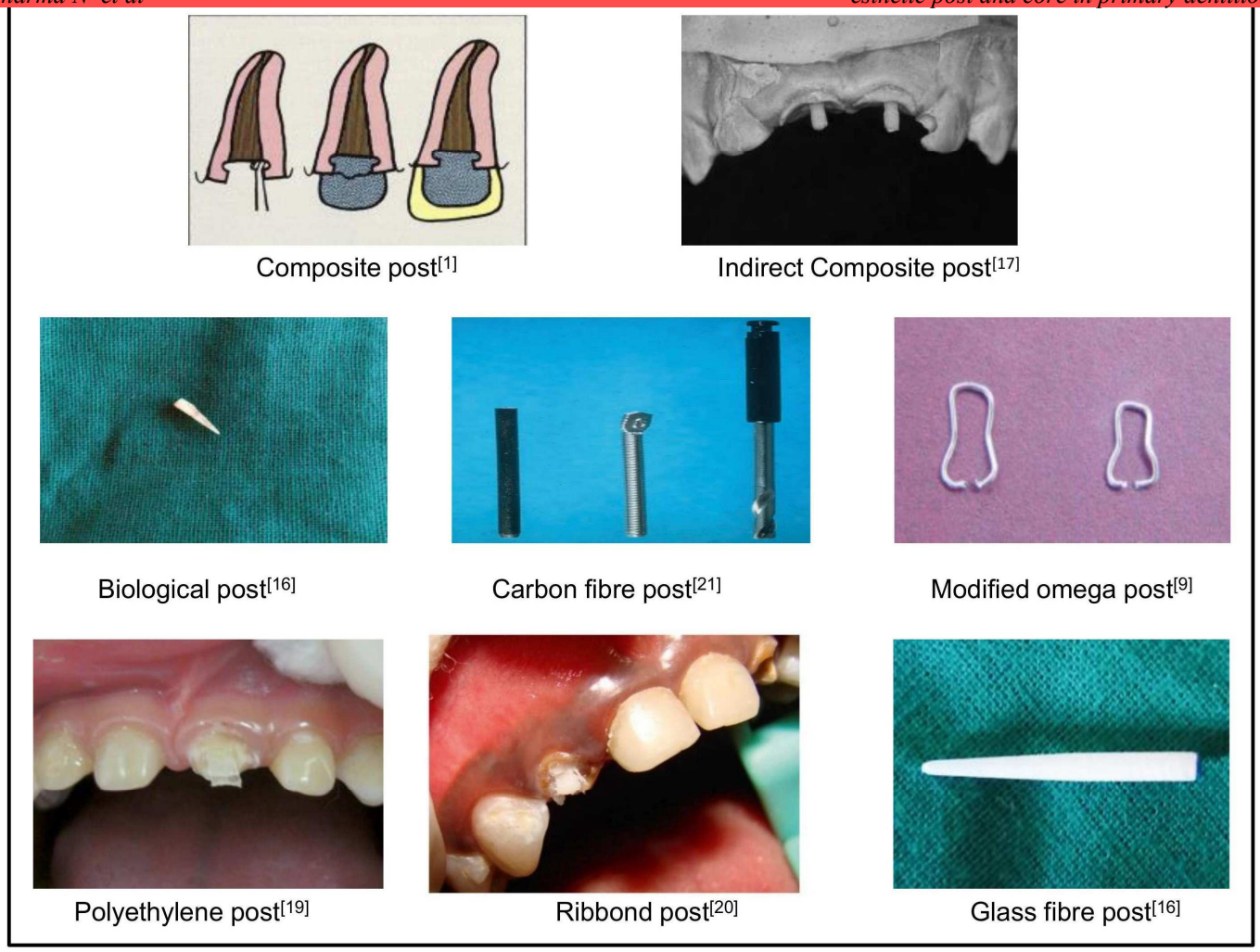
Composite posts can be fabricated directly in post space in the prepared root canal by using composite material. Fabrication of composite post is done by creating an inverted mushroom shaped undercut in the prepared canal, etching and bonding is done and Light-cured composite resin was injected into the canal chamber. The resin short post was light cured in two steps: first the resin in the post preparation, followed by the resin that formed the superstructure of the post. Then the crown was built up over the post restoration. It provides good esthetics but retention of the post can be poor due to polymerization contraction & shrinkage could be a risk. [3] (fig-3)

2. Indirect composite post

Indirect composite post are fabricated extraorally. Post space is created in the obturated root canal and Impression of the canal is then made by using low-viscosity elastomeric impression material with preformed wooden sticks which were of same diameter as post. Composite build up was done on cast for post which was embedded in the root canal over which coronal composite build up was done. [17] (fig-3)

3. Polyethelene Fibre posts

These posts are preferred as they improve the impact strength, modulus of elasticity, & flexural strength. They are almost invisible in resin matrix, in contrast to



Figure—3

contrast to glass fibers, which fail to stick to resin matrix. It is composed of plasma treated ultra-high molecular weight polyethylene fibers woven into three dimensional structure, leno wave or triaxial braid. Because of its special patterns of cross-linked threads, a higher mechanical interlocking is provided, which gives this material high strength and fracture resistance.[18] For the step wise preparation of this post system first removal of 2 mm of the coronal portion of the root filling should be done. Coronal structures and pulp chamber were etched and conditioned properly. Polyethylene fibers conditioned with bonding agent, placed in the slot of the root canal, are stabilized with composite material. Polyethylene fibers, 2 – 3 mm in length, are maintained above the crown to reinforce the coronal structure. [7] [15] [18] (fig-3)

4. Ribbond fibres

These fibres have adequate translucency for cases with great esthetic appeal because they can be camouflaged inside the resin composite structure, as in cases of intracanal reinforcement. They have advantages of easy to manipulate, fall apart, or rebound, maintaining unaltered extension after being cut. Dual cure resin cement is used with ribbond fibres and final restoration is done with composite resin. [15] [16] [19] (fig-3)

5. Glass fibre post

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. 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. [15] [16] (fig3)

6. Glass fibre reinforced composite resin posts

They are new generation of fiber posts composed of densely packed silanated glass fibers in light cure gel matrix. The fibers are of 7 to 10 µm in diameter. Its flexural strength is 1280 MPa which is closer to dentin so decrease root fracture. They have greater ease of handling and can be used in high stress bearing areas. They are invisible in resin matrix so are the most suitable for esthetic needs. The GFRC post cured for 20 seconds in order to gain rigidity, before insertion into the post space. Light cured flowable composite resin is used into the canal chamber after which the GFRC post is inserted.The fiber post & composite are then cured together. The coronal portion of the glass fibre reinforced composite post is splayed to increase the surface area for the retention of the core. [8] [16] [20]

7.Carbon fibre post

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). When the fibres are aligned at an angle to the principal axis of the composite, high transverse strength and moduli of elasticity, similar to those of bone, are achieved. Although the strength of carbon fibre posts decreased by as much as one-third when they come in contact with moisture. [15] [6] [21] (fig-3)

8. Ceramic post

The ceramic post is made of zirconium oxide ceramic which exhibits phase transformation at different temperatures. These transformations cause volume change and stress which are detrimental to zirconia's physical properties, thus yttrium oxide was added as a stabilizing agent to inhibit transformations. 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. Ceramic post includes biocompatibility, its resistance to corrosion and its inability to stain the tooth structure, its outstanding esthetics, resulting from the optical properties of the post material, and in addition, the post can be used directly using composite core or indirectly using the heat pressed technique to achieve a ceramic core build up. [15][16]

9. Biological post

The term biological restoration was introduced by Santos and Bianchi (1991) to describe an alternative technique that uses adhesive capabilities of materials in combination with strategic placement of parts of extracted human teeth. Extracted root stump is placed in a sodium hypochlorite 3% solution in a day for dissolution of organic structure. The surface layer is removed using an ultrasonic scalar and washed thoroughly with saline and hydrogen peroxide. This removes any remnants of organic structure as well as conditions the root stump. It is disinfected and sterilized at 121°C at 15 lbs pressure for 15min. This is stored in saline mixed with hypochlorite till donor is available. [15] [16] [13] (fig-3)

10. Omega post

Omega post is a wire extension made from a 1.5cm length of 0.5mm round orthodontic stainless steel wire which was bent into an omega shaped loop, so creating an "omega wire extension". During construction of the pulpal ends of the wire extension, the wire was bent in such a way as to allow the ends to be hooked in the entrance of the root canal. 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. [6] (fig-4)

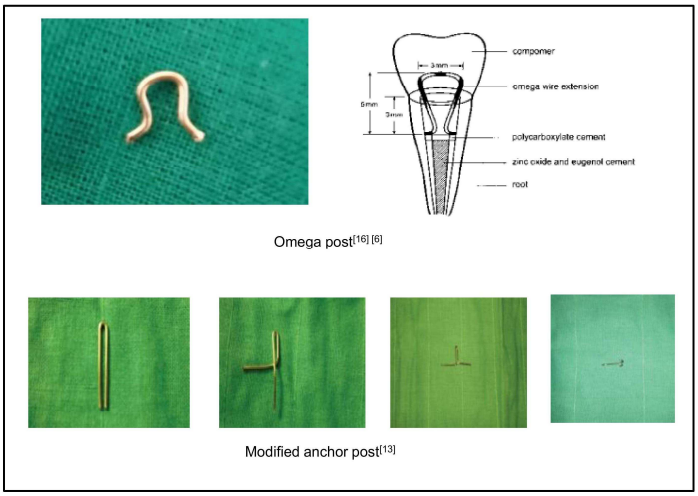


fig-4

11. Modified omega post

A 0.5 mm round orthodontic stainless steel wire was used for making modified omega loop. Using orthodontic No. 130 pliers, a 2-mm length of wire was bent and shaped as an omega loop terminating to two parallel pulpal ends. The loop consisted of an omega wire similar to the original version. This omega-shaped segment projected 2-3 mm above the coronal tooth segment. The omega loop provided extra retention for the restorative material. The intracanal segment consisted of two parallel L-shaped terminals of 3 mm length, which were introduced into the slots prepared at the mesial and distal aspects of the root canals. The insertion of these parallel terminals into the conical root canals resulted in an inward bending and thus the activation of these arms. The terminal short projections of the L-shaped arm acted as an accessory retainer inside the restorative material. [9] (fig-3)

12. Modified anchor post

The intracanal segment consisted of two parallel L-shaped terminals of 3 mm length, which were introduced into the slots prepared at the mesial and distal aspects of the root canals. The insertion of these parallel terminals into the conical root canals resulted in an inward bending and thus the activation of these arms. The terminal short projections of the Lshaped arm acted as an accessory retainer inside the restorative material 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. [13] (fig-4)

Canal preparation for post and core in primary teeth

The root canal treatment is carried out on the tooth over which post and core had to be done. About 4 mm of root canal filling material is removed from the canal. 1 mm of cement is placed over the filling material of the canal. The rest 3 mm canal space is used for the placement of post. [15]

The standard parameters for dowel length in a tooth with normal periodontal support includes :

- 2/3rd the length of canal
- An amount equal to coronal length of the tooth
- ½ the bone supported length of the root.

Advantages of Using Post in Primary Teeth [15] [16]

- Posts primarily provide the necessary retention for the core.
- Posts provide support for the final restoration posts are indicated.
- Posts are used to reestablish the function and the esthetic appeal of severely mutilated primary anterior teeth.
- Posts improve the adhesion of strip crowns by increasing the surface area of the tooth structure on severely diseased primary incisors.
- Posts improve resistance to the mechanical load of the restored teeth.

Disadvantages of the post in Primary Teeth [15] [16]

- Loss of restoration due to fracture of post
- Absolute debonding of the post,
- Thinner hard tooth substance and differences in the amount and distribution of minerals compared with permanent teeth lead to difficulties in achieving predictable and effective bonding of tooth-colored restorative materials.

Core Restorations after Post placement

Single tooth crowns, like polycarbonate crowns, open-faced anterior stainless steel crowns, composite strip crowns, acrylic resin crowns, porcelain veneers, pedo jacket crowns, pedo pearls, artificial glass crowns, cheng crowns, dura crowns, new Millennium crowns could be used to restore the coronal portion of teeth using either a direct or indirect technique.[15][16]

Conclusion

The evolution of posts for primary teeth has revolved the world of esthetics in children. The cast metallic posts, composite posts, preformed posts and esthetic fiber post designs, has been influenced the variety of factors one of which is the need for esthetics. The ideal requirement for a post must includes the functional harmony, biocompatibility, radiopacity, post design, fracture resistance, reinforcement, cementation, and retention. Different types of designs made of different materials are available for the posts in primary dentition. It is therefore up to the practitioner's professional flexibility to select the post system

that best fits the individual situation and techniques that obviate the patients' functional and esthetic demands and save chair time which is favorable during treatment of very young children.

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Conflict of interest

The authors declare that they have nothing to disclose and there is no conflict of interest.

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