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A Short Review on Anterior Esthetic Restorations in Pediatric Dentistry.

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Abstract:
Esthetics have always been a concern irrespective of age or gender. Hence esthetic management of grossly decayed primary teeth has been one of the greatest clinical challenges faced by the Pediatric dentists. An ideal restorative material has thus become an unavoidable requirement in rebuilding the mutilated primary teeth thereby pertaining to its normal form and function. Early childhood caries in young children is one such debilitating condition which demands the rehabilitation of deeply carious, multiple carious lesions. Early childhood caries most commonly occurs in maxillary anterior teeth followed by molars. However mandibular anterior teeth are usually not involved. This prevalence of early childhood caries among maxillary anterior teeth not only compromises the child's esthetics but also affects the child's speech and development. Hence management of these teeth while maintaining the space requirements, esthetics and function have been a matter of concern regarding treatment choices that has to be adopted for rehabilitating such conditions. The increasing demand for esthetics had led to the development of advances in developing newer treatment modalities and concepts. This paper presents a detailed summary of various anterior estethic materials that can be widely used in deciduous teeth in managing these debilitating oral conditions.

Key Words*: Esthetics, Anterior esthetic crowns, Deciduous teeth.*

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I. Introduction

Early childhood caries (ECC) is a rapidly progressing debilitating oral condition that has become a common health concern in today's world. This condition results in premature loss of primary teeth thereby resulting in deleterious effects which include reduced space for developing successor teeth, loss of esthetics and speech abnormalities thereby affecting the overall growth and development of the child.[1] An attractive smile with white teeth had become the beauty standard even among young children and a deviation from these standards will be considered esthetically unacceptable. This thought and perception gradually will lead to child's low self-esteem and pride thereby affecting the child's psychological growth as well. Hence a compromise in esthetics will lead to parafunctional habits, psychological problems and masticatory function. Esthetic restoration of primary anterior teeth possess to be one of the challenging treatment modalities due to small teeth size, close pulp proximity, thin enamel, child's age and behavior and finally the treatment costs.[1] Numerous treatment modalities have been introduced for maintaining better esthetics and retentive features. These include glass ionomers, resin modified glass ionomers, composites, preveneered stainless steel crowns, strip crowns and recently introduced zirconia crowns. Though each of these has got their own limitations they do possess variety of applications confined to their abilities.[1] Therefore the undeniable search for an ideal full coverage restoration still continues in Pediatric Dentistry. This paper presents a review which helps us to analyse the commonly used anterior esthetic crowns in the field of Pediatric Dentistry.

II. Crowns for primary teeth

The most common criterias according to which pediatric crowns are classified include: [1]

1. Based on method of cementation to tooth
   a) Bonded crowns – polycarbonate crowns, strip crowns, pedo jacket crowns, artglass crowns
   b) Luted crowns – stainless steel crowns with facing, Kinder Krowns , Cheng crowns, NuSmile crowns, Dura crowns, Whiter Biter crowns, Pedo Compu crowns, High density polyethylene veneered crowns.
2. Based on material of crowns
   a) Polymer – polycarbonate crowns, strip crowns
   b) Pre veneered stainless steel- Nu- smile Signature
   c) Zirconia – EZ pedo, Nu-Smile ZR
   d) Aluminium veneered with tooth colored material –Pedo pearls

Cemented crowns- Luted crowns

Stainless steel crowns

Stainless steel crowns are one of the earliest crowns in dentistry .These were introduced by the Rocky Mountain Company in 1947 and was popularized by W. P. Humphrey in 1950. They possess high strength, durability and wear resistance. [1] They are highly unesthetic which becomes it's disadvantage in its utilization as an anterior restoration in primary teeth. Stainless steel crowns can be further divided into a) Open faced stainless steel crowns b) Preveneered stainless steel crowns. [1]

Figure 1. Stainless steel crown

Open faced stainless steel crowns

Taking into consideration of esthetic demand in the anterior deciduous dentition stainless steel crowns can be modified for its use in the anterior teeth by an open faced stainless steel crown. For this fenestration is prepared on the labial surface of the stainless steel crown to leave a crown perimeter which is then restored with a resin veneering/ tooth colored plastic material. The esthetics is comparatively fair and provides the advantage of the strength of preformed stainless steel crowns. [2] However the crown placement is time taking as it involves two-step process.

Method of preparation

The preparation begins by first the slicing the mesial and distal surface and removing 1.0 to 1.5 mm incisal edge. [2] Only minimal reduction is needed on the lingual surface. The crown is thenextended 0.5 to 1.0 mm beneath the gingival crest and a hole is made on the labial side of the crown. By using No.114 pliers lingual portion of the crown is adapted to the tooth surface. The crown is polished and cemented with zinc phosphate or glass ionomer cement. When the cement sets, a window is cut using no.58 bur. A composite resins are used to restore the facing of the primary incisor.[2]

ADVANTAGES	DISADVANTAGES
• Highly economical • Easy to use • Adequate tooth adaptation • Esthetically acceptable	• Lack of adequate moisture control. • Presence of gingival hemorrhage. • Prolonged chair side time. • Visibility of metal at gingival crown margin.

Table 1: Advantages and disadvantages of open faced stainless steel crowns.

Preveneered Stainless steel crowns

Preveneered stainless steel crowns were initially introduced for primary anterior teeth and later were also modified for primary molars.[3, 4] They are a combination of conventional stainless steel crowns with composite or thermoplastic resin, combining durability with aesthetics. They served to be a suitable, strong,

unfailing, and esthetic solution to the complicated challenge of restoring severely carious primary incisors.[3, 4] The various available pre veneered crowns are Cheng crowns, Kinder Krowns, Nu-Smile crowns, Dura crowns and Whiter Biter crowns.

ADVANTAGES

These aid in providing good restorations with less chair side time.

Cheng crowns

Cheng crowns were introduced in 1987 by Peter Cheng Orthodontic Laboratories. They are stainless steel pediatric anterior crowns faced with a superior quality composite, mesh based with a light cured composite. [5]

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Figure 2. Cheng crowns

Table 2: Advantages and disadvantages of cheng crowns.

ADVANTAGES	DISADVANTAGES
• One visit procedure • Less technique sensitive • Most accepted crowns • Can be autoclaved • Economic • Stain resistant • Does not cause any wearing of the opposing tooth	• Veneer may fracture

Kinder Krowns

Kinder krowns have shades and contour very similar to natural dentition of pediatric patients. They provide a natural smile without the bulky "Chicklet" look of other restorations. [5] They are available in two shades namely Pedo 1 and Pedo 2. Pedo 2 shade provides the best natural look that Pedo 1. Pedo 1 shade is used where bleached white tooth color is required. Kinder Crowns can be used in fixed bridge fabrication for replacing lost primary central incisors. [5] These crowns also have an additional mechanical retention called as Incisa Lock. [5]

Figure 3. Kinder Krowns

ADVANTAGES

It provides better retention and more space for composite, which makes it strong without sacrificing much tooth structure.

Nu Smile crowns

These crowns have the most natural looking veneer facing. They can undergo heat sterilization without any significant effect on the bond strength and color. They are available in two sizes; regular and large for centrals, laterals and canines. They possess facing on the labial side, allowing crimping on the lingual side. [6]

Figure 4. Nu Smile Crowns

Table 3. Advantages and disadvantages of Nu Smile crowns.

ADVANTAGES	DISADVANTAGES
• Natural looking crowns • Autoclavable • Good esthetics • Increased longevity • Patient- parent's satisfaction • Less chairside time • No discoloration	• Poor gingival health • Costly • Bulky • Crimping may lead to fracture

Dura crowns

Dura crowns are high density polyethylene veneered crowns. It has a full-knife edged margin. These crowns are available in a single shade. Care must be taken to have as much as close fit possible in order to reduce the need for crimping and to minimize the dependence on the strength of the cement. [6]

Figure 5. Dura Crowns

ADVANTAGES	DISADVANTAGES
• Can be crimped both on the gingival facial margin as well as the lingual margin • They can be easily festooned and trimmed with crown scissors • Better esthetics	• Premature failure due to crimping of metal portion as it weakens the esthetic facing • More tooth structure reduction

Table 4: Advantages and disadvantages of Dura crowns.

Whiter Biter crowns

Whiter Biter crowns are preveneered stainless steel crowns which have a polymeric coating with a polyester/epoxy hybrid composition. The coating is very thin but it does not peel or chip off under normal use and mastication. [6]

Pedo Compu crowns

Pedo Compu crowns are stainless steel anterior crowns with high quality composite facing and mesh base with a light cured composite crown. [6]

ADVANTAGES

- Does not cause any wear to the opposing tooth and has color stability
- It provides a natural appearance and is resistant to dental plaque

High density Polyethylene veneered crowns

These are esthetic preformed crowns which are veneered with high density polyethylene that is thermoformed over a preformed stainless steel crown. [7]

ADVANTAGES

- High elasticity
- Great flexural strength
- Can withstand shear force and does not cause chipping and crazing.
- Natural appearance
- High density polyethylene adapts to tooth by mechanical retention and does not disengage easily.
- High density polyethylene has greater density over the composite facing that is commonly used.

Pedo Pearls

Pearls are metal crowns coated with epoxyresin, which serve as permanent crowns for primary teeth. Here aluminum is used instead of stainless steel. The epoxy resin coating adheres better with aluminum surface rather than stainless steel. This was first introduced in 1980. However, the aluminum crowns are quite soft and thus will create problems in the long run. [7]

While using these crowns it is advisable to fill them with either self cure or dual cure composite rather than using regular luting cement. When the epoxy resin coating wears off at the contact point with the opposing tooth, it can be patchedup with more composite. [7]

Contraindication: Avoided in bruxism patients

Figure 6. Pedo Pearls

ADVANTAGES	DISADVANTAGES
Provides good esthetics	• Soft in texture hence hampered in long run • Wears off in areas of heavy occlusion

Table 5: Advantages and disadvantages of Pedo Pearls.

Biologic crowns

It is a technique in which fragment reattachment using natural teeth which is known as biologic restoration. It meets the esthetic as well as standards of natural teeth.[7] This procedure was first published as a case report in 1964 by Chosak and Eildeman. They can be made from fragments selected from natural extracted teeth or from a bank of tooth tissues and can be bonded to the tooth with dual cure composite. [7]

ADVANTAGES	DISADVANTAGES
• Natural esthetics • Superficial smoothness and cervical adaptation compatible to surrounding teeth • Avoids long clinical appointments • Avoids extensive techniques • Inexpensive	• Lack of patient acceptance • Lack of availability of teeth with similar structure, texture and color • Longevity is poor.

Table 6: Advantages and disadvantages of biologic crowns.

Bonded crowns

Polycarbonate crowns

Polycarbonate crowns are type of preformed full coverage crowns which are made of heat-molded acrylic resin. [8] Polycarbonate crowns are aromatic linear polyesters of carbonic acid. Polycarbonate preformed crowns are thinner and more flexible. [8] These crowns are not advised to be used in cases where remaining tooth structure is insufficient for retention, bruxism, crowding and overbites conditions. Hence, these crowns are rarely used today. Polycarbonate crowns are the temporary crowns which can be given in such situation as a fixed prosthesisto deciduous anterior teeth which will get exfoliated in future. [8]

Table 7: Indications and contraindications of Polycarbonate crowns.

INDICATIONS	CONTRAINDICATIONS
• Rampant caries involving three surfaces of the tooth. • After pulp therapy • Tooth malformation • Abutment for space maintainers	• When there is inadequate spacing between teeth. • Crowding of anterior • Deep impinging bite is present • Severe bruxism

Table 8: Advantages and disadvantages of Polycarbonate crowns.

ADVANTAGES	DISADVANTAGES
• Flexible • Better esthetics • Better adaptation • Easy to trim	• Poor retention

Pedo natural crowns

Pedo natural crowns are made of polycarbonate material and offer advantages such as higher flexibility, high durability with superior marginal integrity, and high tensile strength. [8]

Strip crowns

Strip Crowns are prefabricated transparent celluloid crown forms for anterior teeth. They were first introduced in 1979 by Webber et al. The crown automatically contours the restorative material and when it is stripped off, leaving a smooth surface. Hence no polishing is required. The crown forms are filled with composite and then bonded to the tooth surface. Moisture and hemorrhage control is important as it can lead to resin placement failure. [8] They come in 16 different sizes. The crown forms are made only for primary upper left and right central and lateral incisors and for each of these teeth, they come in four different sizes. [8]

Technique: The tooth is isolated and local anesthesia is administered. The tooth is prepared is such a way that the crown of the tooth allows for the bulk of the resin in the final crown form. The length of the crown is reduced incisally using a high speed tapered diamond bur. Mesial and distal side of the tooth are cut to give a knife edge at the gingival margins. Proper shade of the composite resin is chosen. [9] Then celluloid strip-crown forms are selected of right size. Vent holes at the incisal-edge corners of the crown form allow the air to escape when it is filled with composite resin. The crown form filled with composite resins are firmly seated on to the prepared tooth. The composite resin is cured and the celluloid crown form is stripped off using an excavator or a probe. The cured crown is smoothened and polished. [9]

Figure 7. Strip crowns

Table 9: Indications and contraindications of Strip crowns.

INDICATIONS	CONTRAINDIATIONS
• Interproximal caries, multisurface caries on primary anterior teeth • After pulp therapy • Restoration of fractured tooth • Hypoplastic anterior teeth • Amelogenesis imperfecta • Discolored anterior teeth • Congenitally malformed primary incisors	• Insufficient tooth structure for retention • Deep overbite • Bruxism • Periodontal diseases

Table 10: Advantages and disadvantages of Strip crowns.

ADVANTAGES	DISADVANTAGES
• Parent/patient are usually satisfied • Ideal for the build-up of ankylosed tooth • Simple to fit & trim • Removal is fast & easy • Easily matches natural dentition • Leaves smooth shiny surface • Easy shade control with composite • Superior esthetic quality • Ideal for photo cure • Crystal clear and thin • Large selection of size • Easy to repair	• Technique sensitive procedure • Adequate tooth structure removal is required • Difficulty in attaining adequate moisture and blood loss control • Tooth preparation and placement of resin are extensive procedures.

Pedo Jacket Crowns

These were introduced by Space Maintainers Laboratory, USA. The Pedo Jacket crown is made of a copolyester material in the natural primary tooth color shade A2. In these crowns the tooth color polyester "jacket" is filled with resin which will be left on the tooth instead of removing it like a strip crown after polymerization. [9] This is the only flexible or soft crown option compared to the other crowns available on the market. Polishing is not required as the margins are finished before polymerization by removing excess material with a hand instrument. [9]

Figure 8. Pedo Jacket crowns

ADVANTAGES	DISADVANTAGES
• Crown placement can be completed in a single sitting • Cost effective • Multiple adjacent restorations with minimal toothreduction • Crown will not split, stain or crack • Can be trimmed with scissors	• Available in a single color so shade selection is difficult • Cannot be reduced by using high speed finishing bur • Shell stripping commonly seen • Poor color stability

Table 11: Advantages and disadvantages of Pedo Jacket crowns

Zirconia crowns

It was introduced by John P Hansen &Jeffery P Fisher in 2010.Zirconia is a form of crystalline dioxide of zirconium. In particular, the yttrium oxide-partially- stabilized zirconia (3Y-TZP) has mechanical properties very similar to those of metals and yet it has a color same as that of teeth. The mechanical strength of these crowns is similar to that of stainless steel crowns. EZ crowns are the first manufactured zirconia crowns. [10] EZ

Pedo Company developed monolith zirconia pedo crowns as anterior and posterior crowns. They are solid tooth colored material that looks extremely esthetic from front view as well as inside the mouth. More recently, a new type of ceramic material, based on zirconium dioxide, has been developed. Yttria-stabilized tetragonal zirconia polycrystal, Y-TZP, has a unique ability to resist crack propagation. This material is best suited for use in the restoration of posterior tooth. [10]

Cerec crowns

Cerec crowns use CAD/CAM technology for the fabrication of the crowns. The whole procedure can be completed in a single visit. A digital image of the prepared tooth is taken and then converted into 3D computerized model of tooth, which is used as a model for fabrication of the crown. The ceramic blocks come in a wide variety of shades and colors and it is matched and selected as per the adjacent teeth. [10] The commercially available zirconia crowns are EZ Pedo, NuSmile and Kinder Krowns.

Figure 9. Zirconia

ADVANTAGES	DISADVANTAGES
• Single visit • Time saving • No temporization required • Improved esthetics • • Very durable	• Very expensive • Requires extra training on the dentist's part to know the technology

Table 12: Advantages and disadvantages of Zirconia crowns

EZ Pedo crowns

These crowns were developed by Dr. Jeffrey P. Fisher and Dr. John P. Hansen. They are metal-free prefabricated crowns which are made of zirconia. EZ Pedo crowns is constructed with a Zir-Lock® ultra feature which functions to increase the internal surface area to increase bonding. [11] This is because zirconia does no flex, so inherently there will be areas in the subgingival margin where the crowns are open. The Zir-Lock® ultrafeature basically provides mechanical undercuts that lock the crown in place and helps to retain cement at the crown margins to prevent cement loss, prevent microleakage, and also to keep harmful bacteria out. In addition to the in-built retention, then crowns are also treated with aluminum oxide blasting for additional adhesion properties. [11]

ADVANTAGES

NEWER CROWNS

New Millennium crowns

These crowns are very similar to the Pedo Jacket and strip crowns except that they are made of a laboratory-enhanced composite resin material. They are very esthetic and they can be finished and trimmed with high-speed bur. They are also filled with resin and bonded to the tooth. [11]

Artglass® Pedo crowns

Artglass® Pedo crowns was introduced by Glasstech Inc. They are made of bifunctional and multifunctional methacrylates forming a cross-linked three-dimensional polymer. These cross-linked polymers

- Superior esthetics
- Strength
- Durability
- Bioinert
- Resistant to decay and plaque accumulation

are termed as "organic glasses" which mimics the natural feel and good bonding ability with composite. Filler materials incorporated are microglass and silica which provides greater durability and esthetics compared to composite strip crowns. [11]

Figaro crowns

Figaro Crowns are recently introduced crowns for primary teeth. These are said to be all white, metal-free, BPA (Bisphenol-A)-free, and are made from the highest – quality, safest, and time-tested products used in dentistry and medicine today. Figaro Crowns are made in the U.S.A. and possess all ISO Certifications required by Canada Health and the FDA. The technique of crown preparation, selection, and delivery is similar to Stainless Steel crown. [12] Figaro Crowns' materials are said to be

- Biocompatible – It is comprised of the same material as used in pacemakers
- Better strength – These crowns have been created for superior strength to withstand grinding and chewing bite force
- Safe – During clenching or chewing, sharp edges are removed due to grinding or shattering of the crown.
- Cost Effective- Have eliminated the risk of failure at delivery.
- BPA and Metal Free
- Autoclavable

Figure 10. Figaro crowns

III.Conclusion

Esthetics have become a growing concern among today's population. Esthetic dentistry is capable of providing beautiful smile to both the parents and children. Many restorative treatment modalities are available for managing deciduous anterior teeth. However the choice of restorative technique and ideal restorative materials depends upon the esthetic demands of the parents and the child's capability of coping up with the chosen treatment modality. The dental market harbors a wide variety of esthetic anterior crowns for primary teeth. But most of these esthetically acceptable crowns are expensive which refrain the general population from resorting to such treatment options in primary dentition. Hence development of cheaper and esthetically pleasing materials along with creating awareness on the need for restoring deciduous dentition will help in solving this crisis. Thus performing a rehabilitative procedure in primary dentition with esthetics as a prime concern is always an impeding challenge for the pedodontists.

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