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## Review Article

# Gamut of tooth coloured opportunities to reinstate the paediatric smile: A review

Arunima<sup>1</sup>, Vipin Ahuja<sup>1,\*</sup>

<sup>1</sup>Dept. of Pediatric and Preventive Dentistry, Hazaribagh College of Dental Sciences and Hospital, Hazaribagh,, Jharkhand, India



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### ABSTRACT

Early Childhood Caries has been acknowledged as a root of severe decay in children at a global level. Most frequently we see involvement of upper incisors followed by the molars. This disturbs the phonetics and most importantly the aesthetics of the child. Over the years, there have been plenteous studies concerning the restoration of primary teeth. As the technology advanced, the level of parental satisfaction with the conventional stainless-steel crowns lowered, this made the Paediatric dentists to search for an aesthetic restoration for the decayed primary tooth. Treatment of decayed anterior teeth can be done by a variety of techniques which includes Strip crowns, Polycarbonate crowns, Cheng crowns, acrylic crowns, Zirconia crowns and the most recent is Figaro crowns. The advent of such advanced techniques and materials helps in creating beautiful restorations which help children to improve their self-image as the child aesthetics is the guide to the adult aesthetics. This article gives an overview of few of the aesthetic options for rehabilitation of ECC cases.

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## 1. Introduction

Aesthetics is the philosophy of beautiful, that certain detail of a live or inert object that makes it conspicuous. In the Morden world, well contoured and well aligned white teeth place the expected for beauty. Such teeth are not only considered startling, but are also symbolic of nutritional health, confidence, hygiene and economic class. With the growing receptiveness of the available aesthetic options, there is a superior requirement for the solution to displeasing problems such as nursing bottle caries, malformed and discoloured teeth, hypoplastic defects, tooth fractures and bruxism in children.<sup>1</sup>

Aesthetic restoration of primary anterior teeth can be expressly challenging due to the small size of the teeth, close proximity of pulp to tooth surface, relatively thin enamel and surface area for bonding, issues related to child

behaviour and finally cost of the treatment.<sup>2</sup> Preformed crowns are used to restore primary teeth in various treatments in clinical dentistry. The greatest test to the clinician is to re-establish the teeth with a long lasting, retentive, and aesthetic restoration. Primary teeth have a definitive life span of only 6-8 years so a restoration should last at least, without requiring foremost perpetuation.<sup>1</sup>

Anterior teeth are used to be treated with primarily preformed polycarbonate crowns, acid-etched resin crowns, and stainless-steel crowns.<sup>3</sup> However, each came with their own set of advantages and disadvantages which brings us the development of newer type of crowns to replace primary anterior teeth.<sup>4</sup>

This article reviews the several aesthetic possibilities available for restoring the primary incisors and improve the clinician's skill to make the best choice of selection for each specific condition.

\* Corresponding author.

E-mail address: [drvipinahuja@gmail.com](mailto:drvipinahuja@gmail.com) (V. Ahuja).

## 2. Types of full coronal restoration for primary teeth<sup>4,5</sup>

Crowns used to restore primary teeth can be classified in following ways:

- Method of cementation

Cemented crowns and bonded crowns.



**Fig. 1:**

to serve as a convenient, durable, reliable, and aesthetic solution to the difficult challenge of restoring severely carious primary incisors.<sup>5</sup>

Examples of these types of crowns are the Cheng crowns, Kinder Krowns, nusmile, Whiter Biter, Pedo Compu crowns, and Dura crowns.

### 3.3.1. Limitations:<sup>7</sup>

1. The dentist has no choice of resin shade, and the supplied crowns are sometimes so white that they look artificial in the mouth.
2. The labial section of the margin cannot be crimped, because the bonded resin material detach. The uncrimped region, therefore, does not fit as precisely as does a nonveneered steel crown.
3. Crown forms that are tried in, but do not fit, cannot be sterilized under pressure with high heat, because such treatment will destroy the attached resin layer. In this regard, the high cost of each crown to the dentist must be considered.
4. Reshaping of the resin veneers is often necessary to eliminate the overly convex appearance characteristic of these crowns, and this takes additional laboratory or clinical time.
5. Detachment of the tooth-coloured facing is a possibility.



**Fig. 2:**

Full coronal Restoration	
Luted	Bonded
Stainless steel with facing	Polycarbonate
Cheng crowns	Strip crowns
Kinder crowns	Pedo Jacket
Nu-smile	New millinium
Flex crown	Artglass pedo crowns
Dura-crowns	
Whiter bite	
Pedo pearls	
EZ pedo crowns	
EZ Pedo crowns	
Pedo Compu Crowns	
Pedo Natural crowns	

- Based on its material
  - Polymer crowns
  - Preveneered stainless steel crowns
  - Zirconia crowns
  - Aluminum veneered with tooth-colored material crowns.

## 3. Luted Crowns (Cemented)

### 3.1. Stainless steel crowns

Stainless steel crowns are one of the earliest crowns used in dentistry to restore teeth.<sup>4</sup> Introduced by the Rocky Mountain Company in 1947 and popularized by W. P. Humphrey in 1950, they have proved to have high strength, durability, and wear resistance. However, they are highly unesthetic due to the unsightly silver metallic appearance.<sup>6</sup>

### 3.2. Modifications

Facial cut-out stainless-steel crowns or open-faced stainless-steel crowns have composite material substituted in the facial surface of the crown to prevent the unsightly silver colour of steel. Although composite is placed anteriorly, the metal margins are still seen and the procedure to fabricate the crown is time consuming.<sup>4</sup> Clinicians even face problems to control haemorrhage during application of composite facing.<sup>6</sup>

### 3.3. Resin-veneered stainless steel crowns

These have thermoplastisized composite resin bonded to the metal. This type of preveneered crown was developed

### 3.4. Cheng Crowns

Cheng crowns are developed by Peter Cheng in the year 1982. They are stainless steel crowns faced with HIGH QUALITY composite, mesh&#8209;based with a light&#8209;cured composite. They can be used for all anterior and posterior teeth.

#### 3.4.1. Advantages

Colour stability, plaque resistance, and can undergo heat sterilization without affecting its bond strength and colour. It can also be delivered to the child in a single visit and with less patient discomfort.<sup>8</sup>

#### 3.4.2. Disadvantages

They are very costly and during crimping, they often fracture.<sup>8</sup>

There are two variants: classic crowns and the zirconia crowns.<sup>4</sup>

**Table 1:**

Classic crowns	Zirconia crowns
Resin veneered to a stainless steel coping	Zirconia crown is a precision-milled monolithic ceramic crown
Precrimped to give a crimp lock retentive margin to give a more natural emergence profile	Not crimp able
Cold sterilized	Be sterilized by autoclave



**Fig. 3:**

### 3.5. Dura crowns

Dura crowns are made of a high density polyethylene veneered crown. Dura crowns have the benefit of higher retention compared to nonveneered crowns when cementation and crimping are done.<sup>9</sup>

These crowns can be crimped labially, lingually, and can be trimmed with crown scissors and festooned. It also has a full knife edge. Study has shown that these crowns with veneer facings were suggestively more retentive than the nonveneered ones when cement and crimping were combined.<sup>5,9</sup>



**Fig. 4:**

### 3.6. Kinder crowns

Kinder Crowns were introduced in 1989. It propose the most natural shades and contour obtainable for the paediatric patient. They have a highly characterized incisal edge, precisely developed shades, and finely feathered margins. There is a great depth and vitality and divulge an expected smile without the bulky “Chiclet” appearance of other restorations. Kinder Crowns are planned with Incisallock, the finest union of state-of-the-art bonding procedures and mechanical retention. By adding mechanical retention and more composite, Kinder Crowns are strong without losing form or function.<sup>8</sup> It has a universal contour, by which the clinician is able to choose to make the crown a left or right by selectively rounding off the mesial or distal corner.<sup>4</sup>

They come in 2 aesthetically pleasing shades:<sup>4,5</sup>

1. Pedo 1 - shade is for those cases when the bleached white shade is required
2. Pedo 2 - is the most natural shade

#### 3.6.1. Advantages<sup>8</sup>

1. Non – bulky
2. Good natural shade
3. Better retention

### 3.7. Pedo pearls

These crowns were first introduced in 1980. These are fascinating heavy gauge aluminium crowns coated with FDA food grade powder coating and epoxy-resin. The difference was that the metal used was aluminum in place of stainless steel.<sup>1</sup> They serve as decisive permanent crown for primary teeth. While using these crowns it is wise 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 strengthened up with more composite.

### 3.7.1. Advantages

Universal anatomy, use on either side, Easy to cut and crimp, without chipping or peeling. Composite can be added

### 3.7.2. Disadvantages

Less durability, relatively soft,<sup>10</sup> should be avoided in the patients with a history of bruxism<sup>1</sup>



**Fig. 5:**

### 3.8. Nusmile crowns

Nusmile crowns were introduced in the year 1991. They are also made of stainless steel with an even more natural appearing tooth colored coating. They are indicated for full coverage restorations when a crown is needed for durability and to protect remaining tooth structure.<sup>11</sup>

Availability: Available in 2 sizes i.e regular and large for centrals, laterals and canines.

### 3.9. Types

The nusmile Signature and nusmile ZR.

The nusmile Signature crowns are anatomically correct with a natural tooth colored coating which is a substitute to the traditional stainless steel and composite strip crowns. Nusmile ZR, on the other hand, is made from a high grade monolithic zirconia ceramic which offers superior esthetic and durability compared to the nusmile Signature. Nusmile crowns come in a universal style where the anterior crowns are fabricated with both point angles slightly square. The clinician may round off either angles to make it a right or left sided crown.

They have facing only on the labial side, allowing crimping possible only on the lingual side

They come in extra light or light pedo shade. Light crowns are comparatively more yellow compared to the original pedo shade.

#### 3.9.1. Advantages

Natural looking crowns, Autoclavable, Good aesthetics, Increased longevity, Patient- parent's satisfaction, less chairside time.

#### 3.9.2. Disadvantages

Poor gingival health, Costly, Bulky, Crimping may lead to fracture.<sup>6,11</sup>



**Fig. 6:** Nu smile signature



**Fig. 7:** Nu smile Zirconia

#### 3.10. Whiter Bite crowns

These crowns have a polymeric coating with polyester or epoxy hybrid composition. The coating is thin, it does not flake off easily.<sup>4</sup>

#### 3.11. Pedo Compu crowns

They are also type of stainless-steel crowns with a high-quality composite facing and mesh based with a light-cured composite crown. They are plaque resistant and have good colour stability.<sup>5</sup>

#### 3.12. EZ Pedo crowns

These crowns were introduced to the dentistry by Dr. Jeffrey P. Fisher and Dr. John P. Hansen. EZ-Pedo (EZ-Pedo, Loomis, CA, USA) was the first pediatric zirconia crown

commercially accessible in the United States, and initially advertised in 2008.<sup>12</sup> They are metal-free prefabricated crowns which are made of zirconia. They have superior aesthetics, strength, durability, and are completely bioinert. It is also resistant to decay and plaque accumulation. They are found to prevent the *Streptococcus mutans* adhesion onto its surface, and diminished plaque collection around the crown and less irritation of the encompassing gingiva when contrasted with Stainless steel crowns.<sup>13</sup> EZ Pedo crowns is created with a Zir-Lock ultrafeature which roles to increase the internal surface area to increase bonding. This is because zirconia does no flex, so intrinsically there will be areas in the subgingival margin where the crowns are open. The Zir-Lock ultrafeature chiefly provides mechanical undercuts that lock the crown in place and helps to retain cement at the crown margins to avoid cement loss, prevent microleakage, and also to retain harmful bacteria out. Moreover, to the incorporated retention, the crowns are also treated with aluminium oxide blasting for extra adhesion properties.<sup>4</sup>

### 3.13. *Pedo natural crowns*

1. These crowns are made of polycarbonate material

#### 3.13.1. *Advantages*

Higher flexibility, high durability with superior marginal integrity, and high tensile strength.<sup>14</sup>

### 3.14. *Bonded crowns*

#### 3.14.1. *Polycarbonate crowns*

Polycarbonate crowns are heat-molded acrylic resin used to restore anterior primary teeth. These are aromatic linear polyesters of carbonic acids. They are named as thermoplastic resins because they are moulded as solids by heat and pressure into the desired form. Their heat distortion point is about 270°F. Polycarbonate crowns are stable dimensionally, as evidenced by +/- 0.001-inch tolerances during molding. These crowns show high impact in strength and rigidity.<sup>15,16</sup>

#### 3.14.2. *Polycarbonate Crowns Include:*<sup>17</sup>

1. 3M ESPE Polycarbonate
2. Kudos polycarbonate crown

#### 3.14.3. *Indications*<sup>15,16</sup>

1. The class III cavities which are treated with composites
2. When the caries is severe
3. After pulp therapy

#### 3.14.4. *Contraindications*

1. When there is inadequate spacing between teeth.
2. Crowding of anterior

3. Deep impinging bite is present
4. Severe bruxism
5. When there is evidence of abrasion in the anterior teeth.

#### 3.14.5. *Advantages*

1. Less time consumption
2. Better aesthetics
3. Extreme dimensional stability.

#### 3.14.6. *Disadvantages*

1. Poor abrasion resistance



Fig. 8:

### 3.15. *Strip crowns*

Strip crowns were first familiarized in 1979 by Webber et al.<sup>17</sup> And further designated by Grosso F.C (1987)<sup>14</sup> and are now being castoff for variety of clinical conditions both in the primary and permanent dentition. These are frequently used Crown forms filled with composite & bonded on the tooth. Their high-level aesthetic presence has made them popular among other aesthetic crowns. Composite strip crowns depend on dentin and enamel adhesion for retention. Therefore, the lack of tooth structure, the presence of moisture or haemorrhage contributes to compromised retention. These are crown forms filled with composite and are bonded onto the tooth and the crown form is then removed. Although aesthetically appealing, but its retention depends on the amount of tooth structure remaining after excavation of caries. This is the foremost choice of most clinicians as it can be easily repaired if the crown fractures or chips off.<sup>1,4,14,17</sup>

#### 3.15.1. *Advantages*<sup>17</sup>

1. Highly esthetic
2. Restores function
3. Durable restoration
4. Economical when compared with the veneered crown
5. Less injurious to the pulp in a vital tooth
6. Causes fewer traumas to the periodontium

7. Better retained than the polycarbonate crowns

### 3.15.2. Disadvantages

1. Technique sensitive
2. Retention depends on the amount of tooth structure remaining after the caries has been removed.
3. Haemorrhage during the procedure can adversely affect the esthetics of the crown
4. Saliva contamination during the procedure also affects the retention of the crown
5. Cannot be used in cases of severe bruxism
6. Cannot be used in cases of excessive overbite



**Fig. 9:**

### 3.16. Pado jacket crowns

Pado Jacket crowns are made known to the dentistry world by Space Maintainers Laboratory, USA. This is the only flexible or soft crown option related to the other crowns accessible in the market. Pado jacket crown is like celluloid crown form, except for the pado jacket is made up of a tooth-coloured co polyester material with natural tooth colour shade A2, which is filled with resin and left on the tooth after polymerization instead of being removed.

#### 3.16.1. Disadvantage

1. It can neither be contoured nor aligned with a high-speed bur.
2. They show wear in areas of heavy occlusion load.
3. They do not have good colour stability
4. It is available in only one shade, which is very white, so shade matching is difficult.

#### 3.16.2. New millennium crowns

These crowns are very similar to the Pado Jacket and strip crowns except that they are made of a laboratory enhanced composite resin material. They are very esthetic and unlike Pado Jacket crowns, they can be finished and trimmed with high-speed bur. They are also filled with resin and bonded to the tooth.<sup>4,14</sup> However, disadvantages include that they are

very brittle and more expensive than other crown forms and cannot be crimped.<sup>18</sup>



**Fig. 10:**

### 3.17. Artglass® Pado crowns

Artglass® Pado crowns are introduced by Glasstech Inc., so also called Glasstech crown. They are made of bifunctional and multifunctional methacrylates forming a cross-linked three dimensional polymer.

These cross-linked polymers are named “organic glasses” which imitates the natural texture, bond ability of composite but with esthetics comparable to porcelain.



**Fig. 11:**

The exclusive filler materials which are microglass and silica in glasstech provide greater durability and esthetics compared to composite strip crowns. Failures occur in case of these crowns are due to bond failures.<sup>19,20</sup>

## 4. Recent Development in Aesthetic Dentistry

### 4.1. Figaro crowns

Figaro crowns have been freshly added to the lean of aesthetic full coronal crowns restoration in paediatric

patients. These crowns apply either fiberglass or quartz filaments/fibres embedded with an outer cosmetic composite resin material. This resin crown made out of medical-grade composite which is also seen in pacemakers, ocular and cochlear implant devices which is biocompatible to a great extent. The strength and biocompatibility with a degree of elasticity are much closer to tooth structure than stainless steel and zirconia crowns. The crowns imitate the true anatomy of a natural tooth. While zirconia and SSC are limited in copying the tooth's shape and more strictly resemble cusp and grooves, Figaro crown encirclements the true tooth's anatomy, creating an aesthetically beautiful result with cusps and grooves. Figaro crowns can be adjusted for cosmetic, grinding and/or eccentric occlusion purposes. This is a feature that no other preformed crown permits. They provide the unmatched aesthetics and beauty of an all-white crown while offering superior strength and the highest value available in the market. It saves both time and money.

#### 4.1.1. Other advantages include

1. It requires less tooth reduction than zirconia crown
2. There is no need to wait for cement to set for delivery
3. Wall thickness of this crown is 0.5–1 mm which is very close to stainless steel and much thinner than other white crowns due to flex fit technology
4. Preparation for tooth reduction is still similar to stainless steel with no subgingival preparation so the tooth preparation is less aggressive.<sup>18,21</sup>



Fig. 12:

#### 4.2. Zirconia crown

It was introduced by John P Hansen & Jeffery P Fisher (2010). Zirconia is a crystalline dioxide form of zirconium. These are crowns made of zirconia for the primary dentition that contain no metal. Zirconia is presently the strongest dental ceramic available and is also aesthetically attractive. They are anatomically contoured, metal free, completely

bio-inert, and resistant to decay. Even though zirconia is widely accepted as a restorative material for the permanent dentition, it is a relatively new restorative material for the primary dentition.<sup>1,14,22</sup>

Some of the commercially available pediatric zirconia crowns are:

1. Pedo crowns
2. Nusmile Zirconia crowns
3. Cheng Zirconia pediatric crowns
4. Kinder Zirconia

#### 4.3. Others available crowns

Pediatric crowns Prefabricated zirconia crown (EZ-Pedo, Loomis, CA, USA; nusmile ZR Primary Crowns, Houston, TX, USA; Hu-Friedy Mfg. Co., LLC, Chicago, IL, USA; Kinder Crowns, St. Louis Park, MN, USA; Cheng Crown, Exton, PA, USA; Zirkiz&#8209;Hass Corp.Korea.)<sup>18,22</sup>

#### 4.4. Characteristics of the Zirconia crowns

1. They are thermostable
2. Have low heat conductivity
3. Have low thermal expansion
4. Are biocompatible
5. Have high strength, hardness
6. High abrasion resistance
7. Colour stable
8. Retain a high polish
9. Very natural look

#### 4.5. Disadvantages of the Zirconia crowns.<sup>14,22</sup>

1. These crowns cannot be crimped or contoured to fit a crown preparation. Similar to a veneered crown, when placing a Zirconia crown, the preparation must be made to fit the crown rather than the crown fitting the prep.
2. Take a lot of trial and error in preparation.
3. These crowns must fit passively.
4. They cannot be forcefully pushed onto a tooth. This also means that the margins cannot be adjusted for a tighter cervical fit. Haemorrhage must be well controlled
5. Cost

#### 4.6. Flex crowns

They are white faced, overcome the aesthetics problems associated with plain stainless-steel crowns. These crowns can be manipulated and handled similar to the conventional stainless-steel crowns.<sup>23</sup>



**Fig. 13:**

#### 4.7. Life like paediatric crowns

They are highly durable and aesthetically translucent thus are claimed to deliver natural tooth like appearance to the restored tooth. These crowns have a stable colour which does not stain, discolour or fade.<sup>23</sup>

### 5. Conclusion

Numerous alterations and newer aesthetic crowns have been accessible to overcome the drawbacks of stainless-steel crowns. Crowns were presented to encounter the growing aesthetic demands of patient as well as their parents. The pedodontics has a wide collection of aesthetic crowns existing for restoring primary anterior teeth. But widely held, these crowns are manufactured only for maxillary primary anterior teeth. If full coronal restoration of mandibular incisors is desired, it requires the use of a maxillary lateral crown form, which regrettably, results in a very massive looking restored incisor. Other downsides of these crowns are that a limited crowns are expensive and cannot be available for the patients belonging to lower socioeconomic strata of the society. The prettiness of the aesthetic crown will depend on the clinician's knowledge, child's behaviour, and retention of the crown and proper care of the oral hygiene.

### 6. Conflict of Interest

The authors have stated explicitly that there are no conflicts of interest in connection with this article.

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None

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### Author biography

**Arunima**, Post Graduate Student

**Vipin Ahuja**, Professor and Head

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