



## Crowns in Primary Dentition: A Review

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### ABSTRACT

One of the most common problems faced by clinicians in Pediatric Dentistry is to provide restorations in primary and young permanent teeth which are aesthetically acceptable, durable and cost effective. A wide range of crowns are available for this purpose and the selection of the most appropriate crown will help achieve better final outcomes of treatment. They vary widely from being the directly bondable to the tooth surface to crowns which are luted onto the tooth surface. They may also vary in composition from metal crowns with or without facings to resin, polycarbonate, and ceramic crowns. This review attempts to assimilate and bring out the varied array of pediatric crowns available in the published data for utilization by the Pedodontist as per the needs of the patient. The knowledge of the available resources and the various advantages, disadvantages and properties of the same will go a long way in enhancing the clinician's ability to make the most appropriate choice for the patient.

**KEYWORDS** – Pediatric Crowns , Primary Dentition , Stainless Steel Crowns , Pediatric Zirconia Crowns

### I. INTRODUCTION

Early childhood caries (ECC) is the presence of one or more cavitated or non-cavitated carious lesions before a child's sixth birthday. Severe early childhood caries (S-ECC) is smooth surface caries in a child less than three years old.<sup>1</sup> Recent reports from several studies show that the incidence of ECC in India is about 40% to 60%.<sup>2</sup> Early childhood caries has consequences not only for the teeth of the affected child, but also for the child's general health as brought out by the Surgeon General of the USA stating "You cannot be healthy without good oral health".<sup>3</sup> The consequences of ECC can range from pain , sepsis, space loss, disruption of quality of life, disruption of growth and development, possible disruption of intellectual development, higher incidence of hospitalisation, increased treatment costs and greater risk of new carious lesions in both primary and permanent dentition.<sup>4,5,6,7,8,9,10</sup> Thus it becomes the responsibility

of the Pedodontist to restore teeth affected by ECC to repair or limit the damage from caries, protect and preserve the tooth structure, re-establish adequate function, restore esthetics, and provide ease in maintaining good oral hygiene.<sup>11,12</sup>

Restoration of primary teeth differs from restoration of permanent teeth, due to the differences in tooth morphology. The mesiodistal diameter of a primary molar crown is greater than the cervico - occlusal dimension. The buccal and lingual surfaces converge toward the occlusal. The enamel and dentin are thinner. The cervical enamel rods slope occlusally, ending abruptly at the cervix rather than being oriented gingivally and gradually becoming thinner as in permanent teeth. The pulp chambers of primary teeth are proportionately larger and closer to the surface. Primary teeth contact areas are broad and flattened rather than being a small distinct circular contact point, as in permanent teeth. Shorter clinical crown heights of primary teeth also affect the ability of these teeth to adequately support and retain intracoronal restorations. Young permanent teeth also exhibit characteristics that need to be considered in restorative procedures, such as large pulp chambers and broad contact areas that are proximal to primary teeth.<sup>13</sup>

Aesthetic crowns and stainless-steel crowns for primary teeth offer a practical alternative with distinctly enhanced success rates as compared to multisurface restorations. The lifespan of multisurface amalgam restorations is markedly shorter in the primary dentition than in the secondary dentition.<sup>14</sup> This review article aims to provide the dental practitioner with the various alternatives available to manage carious lesions related to ECC in primary dentition.

### Crowns For Anterior Teeth

A variety of aesthetic restorative materials are available for restoring primary incisors. Knowledge of the specific strengths, weaknesses and properties of the materials will help the clinician to make the best choice for each situation. The class III and class V restorations in primary dentition are highly technique sensitive and depend largely on isolation, hemorrhage control from the gingiva



morphology and anatomy of primary dentition.<sup>15</sup>The anterior aesthetic crowns are a more reliable alternative and can provide the child with a more aesthetic alternative.

Indications for anterior Full coronal restorations:

Full coronal restoration of carious primary incisors may be indicated when:(1) caries is present on multiple surfaces,(2) the incisal edge is involved,(3) extensive cervical decalcification,(4)

pulpal therapy is indicated,(5) caries may be minor, but oral hygiene is very poor ,(6) the child's behaviour makes moisture control very difficult.

The various types of crowns available for restoring anterior teeth can be divided into two main types (1) those that are preformed and held onto the tooth by a luting cement, and (2) those that are bonded to the tooth (Table 1).

Table 1. Esthetic Crowns for Primary Teeth

Crown	Company	Additional Information
Stainless Steel crowns	3M Espe-Unitek, Rocky Mountain Company	Available in two types resin veneered and facial cut out stainless steel crowns.
Pedo Pearls	Mid-West Dental	Aluminium crowns coated with epoxy paint.
Pedo Compu Crowns		Anterior stainless-steel crowns with composite facing.
Whiter Biter Crowns	White Bite Inc	Polyester/Epoxy hybrid crowns with polymeric coating.
NuSmile Crowns	Orthodontic Labs	1. SSC crowns with facing - Resin facing on an SSC only lingual surface can be crimped. 2. Zirconia crowns - good aesthetics. Fabricated using CT digital scans of deciduous teeth. Available in two shades.
Cheng Crowns	Peter Cheng Orthodontic Labs	1.Pre-Veneered Crowns - Resin facing on an SSC only lingual surface can be crimped. 2. Zirconia Crowns – Precision milled monolithic ceramic crown with pre crimped margin.
Kinder Krowns	Mayclin Dental Studios	1. Pre-Veneered Crown -Resin facing on an SSC only lingual surface can be crimped. It has strengthened stainless steel crown with feathered margin for better fit. 2. Zirconia Crowns – provides excellent aesthetics. Has internal retention system in the form of retention bands. Available in two contours universal or right and left.
Dura Crowns	Space Maintainer Laboratory	Flexible facing attached to SSC. They can be crimped labially and lingually.
New Millenium Crowns	Space Maintainer Laboratory	Lab-enhanced composite resin crown form.
Pedo Jackets (Polycarbonate Crowns)	Space Maintainer Laboratory	Co polyester crown form one shade.
Strip Crowns	Space Maintainer Laboratory	Seamless plastic crown forms.
Artglass Crowns	Glasstech Inc	A polymer glass crown which provides the esthetics and lasting qualities of porcelain.
EZ Pedo zirconia crowns	Sprig	Metal free prefabricated zirconia crowns which have superior aesthetics. These crowns have mechanical undercuts to help



		retain cement at crown margins to prevent microleakage.
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### Anterior Stainless-Steel Crowns

Preformed stainless steel crowns (SSC) are considered to be the most durable and reliable for restoring severely carious deciduous incisors. SSCs have been found to be easy to place, fracture proof, wear resistant, and attached firmly to the tooth until exfoliation.<sup>16,26</sup> The silver metallic appearance was the main disadvantage as brought out by Croll. The other alternative was the use of a stainless steel crown in which a labial fenestration was made in which a resin or composite material was placed in order to improve the aesthetics. This technique provided a great improvement in aesthetics although it was time consuming and the metal margins could be seen.<sup>16</sup>

### Resin-Veneered Stainless-Steel Crowns

The resin – veneered stainless steel crowns were introduced in the early 1990s. There are many commercially available brands of veneered SSCs in the market today eg Kinder Krowns, NuSmile, and Cheng Crowns. The lingual margins can be crimped improving the marginal fit of the crowns (table 1). More recently, a resin-veneered crown—Dura Crown (Success Essentials Space Maintenance Laboratory, Chatsworth, Calif)—was introduced. This crown has the labial gingival margin crimped and resin adapted to the gingival edge of the anterior aspect of the crown. The failure of the resin veneer and metal bond leading to chipping off exposing the metal margins is a major disadvantage. Failures occurred most commonly at resin-resin and resin-metal interface.<sup>17, 18</sup>

### New Millenium Crowns

These crowns are made up of Lab enhanced composite resin material which is expensive. They are quite similar to Pedo jacket crowns. They can be trimmed easily but are brittle. These crowns are bonded to the tooth. There are no long term studies available with respect to these crowns.<sup>19</sup>

### Polycarbonate crowns

Polycarbonate crowns are heat-moulded acrylic resin used to restore anterior primary teeth. Although more esthetic than the SSCs, the polycarbonate crowns are easy to trim and can be adjusted with pliers. These crowns do not resist strong abrasive forces thus leading to occasional fracture.<sup>20</sup>

### Strip Crowns

Strip crowns are celluloid crown forms which are a popularly used for restoring primary anterior teeth. These crown forms provide superior aesthetics when compared to other forms of full coronal anterior coverage. The procedure of their placement is very technique sensitive and care has to be taken in patient selection, moisture and haemorrhage control, tooth preparation, adhesive application and resin composite placement. These crowns rely on dentin and enamel adhesion for retention, the presence of enough tooth structure for bonding of the composites is essential for the long term success of these crowns. The name strip crown has been coined because after the composites are cured on the tooth surface the colloid crown forms are stripped from the surface.<sup>21</sup>

### Artglass Crowns

These crowns contain bifunctional and new multifunctional methacrylates forming a cross-linked, three dimensional polymers. The filler content in these polymers is 75% and the fillers used are microglass and silica which provide greater durability and aesthetics. They are colour stable, wear of polymer glass is similar to enamel, kind to opposing dentition and is plaque resistant. They are available in one shade and in 6 sizes for primary central, lateral and cuspid teeth. The major cause of failure with regard to these crowns is due to bond failures.<sup>22</sup>

### Zirconia Crowns

These crowns are new to pediatric dentistry and have the advantage of superior aesthetics. They are commercially available in the market as various brand names e.g. EZ Pedo , Nu Smile ZR , Zirconia Kinder Krowns and Cheng Zirconia Crowns. Zirconia is one of the most promising ceramics with enhanced mechanical properties and excellent aesthetics . It has the added advantage when used for pediatric crowns over preveneered stainless steel crowns of higher fracture resistance and flexural strength.<sup>23</sup>

### Crowns For Posterior Teeth

The morphology of a primary molar tooth differs significantly from its permanent successor, especially with respect to its greatest convexity at the cervical third of the crown. This undercut can be utilised for the retention of the crown whose margin can be crimped to fit into the cervical constriction. The enamel and dentin of the primary molar crown



are proportionally much thinner than in the permanent tooth and are relatively susceptible to caries attack. The primary pulp is large with prominent pulp horns and is situated in close proximity to the mesial surface of the tooth crown, particularly in mandibular primary molars. This is important as it makes cavity design to be very conservative. This conservative cavity design coupled with difficulty in isolation and hemorrhage control is the cause for most failures in restorations in posterior primary dentition. The various types of crowns available for restoration of posterior primary teeth include stainless steel crowns, custom made composite and acrylic crowns.

### **Stainless Steel Crowns**

Stainless steel crowns were introduced to pediatric dentistry by the Rocky Mountain Company in 1947 and made popular by W. P. Humphrey in 1950. Until then the treatment for grossly decayed primary teeth was extractions. Stainless steel crowns are prefabricated crown forms that are adapted to individual teeth and cemented with a biocompatible luting agent.

Indications for full coverage coronal restorations in deciduous primary teeth:

Full coverage coronal restorations may be indicated in posterior primary teeth when 1. Children at high risk exhibiting anterior tooth caries and/or molar caries may be treated with crowns to protect the remaining at-risk tooth surfaces.

2. Children with extensive decay, large lesions, or multiple-surface lesions in primary molars, developmental defects (e.g., hypoplasia, hypocalcification) should be treated with crowns.

3. Strong consideration should be given to the use of crowns in children who require general anaesthesia e.g. special children who may not be able to maintain good oral hygiene.<sup>24</sup>

In high caries-risk children, definitive treatment of primary teeth with SSCs is better over time than multisurface intra-coronal restorations. Review of the literature comparing SSCs and Class II amalgams concluded that, for multisurface restorations in primary teeth, SSCs are superior to amalgams.<sup>25</sup>

### **Composite Crown-Form**

With increased expectations of parents and children towards aesthetics as well as function, together with improved diagnostic and material advances, aesthetics have become very important. These developments include the availability of

improved composites for anterior and posterior use. The composite crown-form crowns can be used to restore severely decayed primary molars. Etching is performed followed by bonding and curing with halogen light. Then, the crown form matrices were filled with a composite resin and placed over the decayed teeth from lingual to buccal. The crowns are then cured for 20 secs on each side of the tooth. The crown form matrix is removed with a sharp carver and the margins are polished. The occlusion is checked using an articulating paper and high points are then reduced.<sup>27</sup>

### **Zirconia Crowns**

The success and reliability of stainless-steel crowns for restoration of primary teeth has been proven, however they have the disadvantage of poor aesthetic appearance. Zirconia crowns for restoration of primary posterior teeth is a more aesthetic option. The other advantage of zirconia crowns is that they have good mechanical properties in terms of high fracture resistance and flexural strength, however to achieve these properties these crowns are thicker compared to stainless steel crowns and hence have the disadvantage of greater tooth preparation. The other significant drawback is the increased cost of zirconia crowns in comparison to stainless steel crowns. These crowns are available in the market in brand names such as EZ Pedo, Nu Smile ZR, Zirconia Kinder Crowns and Cheng Zirconia Crowns.<sup>28,29</sup>

## **II. CONCLUSION**

Early Childhood Caries is a significant public health problem in both developing and industrialized countries which continues to affect babies and preschool children worldwide.<sup>2</sup> Early childhood caries (ECC) is not life-threatening but causes symptoms e.g. tooth ache, systemic infection, affect on speech articulation, growth, and dietary practices. This ultimately influences nutrition, concentration and subsequently school participation. Many options exist to repair carious primary teeth, as restorations in primary teeth are more difficult to do and may not last for a long period because of their anatomical and morphological considerations. There are a variety of crowns available for restoration of deciduous teeth and these crowns have been in use for years with much success. Operator preferences, esthetic demands by parents, the child's behavior, and moisture and hemorrhage control are all variables which affect the decision and ultimate outcome of whatever restorative outcome is chosen.<sup>30</sup> It is therefore very important to take into account



findings of various clinical studies before choosing the restorative techniques for a child. The Pedodontist needs to keep abreast with the latest restorative techniques and keep in touch with the newer techniques available to provide comprehensive care for children using these crowns to not only restore function but also to provide superior aesthetics.

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