

Crowns in Pediatric Dentistry - A Review

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ABSTRACT

It is important to maintain the primary dentition in a healthy condition for the overall well being of the child. Early childhood caries has remained as a significant issue challenging the dentists diagnosis, preventive and restorative skills. Caries in young children most often involves the anterior teeth and primary molars of the maxilla. Treatment of such poorly destructed teeth is a challenge. Patient's behavioural management, preserving the tooth structure and satisfaction of the parents are factors to

be considered and kept in mind. Various approaches for full coverage pediatric restoration have been brought into the practice with great effort. Each approach, technique and material has its own advantages and disadvantages. Options such as stainless steel crowns to modified aesthetic crowns like strip crowns and zirconia crowns which have become popular have been discussed in this literature.

Key Words: Crowns; caries; pediatric; preventive; restorative

INTRODUCTION

60% to 90% of school children in industrialized countries have been affected by dental caries, which has become a significant problem [(1)]. An inspection programme has stated that more than 50% of five year old children had decayed primary teeth, with an average of five decayed teeth in these children. This has become a huge problem as treatment is required and has implications on parents and public health [(2)]. Our institution is passionate about high quality evidence based research and has excelled in various fields (3–13)

The objective of the placement of a crown is to bring about an aesthetic enhancement. This can positively affect the patient's self image. The texture, shade and shape should be corrected along with good form and function which can prevent further deterioration by inhibiting tooth migration, bone loss and collapse of the arch.

Classification According to Babaji et al. [(14)]

Based on Material Used

- All metallic crown
 - Stainless steel crown (SSC/PMC)
 - Aluminum crown
- Stainless steel crowns (SSC) with facing
- Resinous/composite crown
 - Strip crown
 - Composite shell crown
 - New millennium crown
 - Glass ionomer crown
 - Polycarbonate crown
 - Kudo crown
 - PodoNatural crown
 - Podo jacket crown
 - Artglass crown.
- Preveneered stainless steel crown (PVSSC): SSC with composite, resinous, HDP, polyethylene or epoxy facing
 - NuSmile crown
 - Flex crown

- Pedo pearls
- Cheng crown
- Whiter Biter crown
- Pedo compu-crown
- High density polyethylene (HDPE) crown
- Dura crown.

- Ceramic (Zirconia) crown
 - ZIRKIZ crown
 - EZ-crown
 - Kinder Krown
 - CEREC crown
 - Ceramo basemetal crown.
- Biologic crowns

Classification of Crowns According to Bonding or Luting of Full Coronal Restoration

- Luted
 - Stainless steel crown
 - SSC with facing
 - Ceramic crowns.

- Bonded
 - Resin based
 - Composite based
 - Natural tooth.

The above available options that provide full coverage restoration for primary teeth have its own advantages and disadvantages. SSC and its modifications, polycarbonate crowns and strip crowns are the most commonly used full coverage crowns. To restore primary and permanent posterior teeth SSC have been used for the past 50 years. They are prefabricated crowns that adapt to individual teeth and are cemented with a biocompatible luting agent. SSC is comparatively inexpensive, highly durable, mless technique sensitive and provides full coronal coverage (15). A number of articles support the success of SSCs that have been used to restore grossly decayed teeth or pulpotomized primary molars [(16), (17), (18)]. The main drawback of SSCs is their poor aesthetic appearance.

Open-face SSCs are another solution to SSCs, although they have several disadvantages such as time consumption and require additional preparation, are technique sensitive and use a lot of materials [(19)]. Strip crowns (resin bonded crowns) are being used for decayed or fractured maxillary primary incisors and they show very good aesthetic appearance with longevity although they are very much technique sensitive [(20)]. Polycarbonate crowns are another treatment option to restore aesthetically the anterior primary decayed teeth. These are more aesthetic than SSCs, easy to adjust and trim and require comparatively less chair side time.

All the above methods have their own shortcomings but each of them can be used in some circumstances. Search for the ideal crown in pediatric dentistry continues. The aim of this review is to analyze the recent developments, advancements and trends regarding crowns in pediatric dentistry.

Preformed metal crowns (PMC)

Preformed metal crowns, also known as stainless steel crowns were introduced to pediatric dentistry in 1950 by Humphrey [(21)]. They were initially made of stainless steel and were known by an acronym of SSC. However the metal that was used was changed to nickel-chromium and best known as a preformed metal crown (PMC). They have become an essential restorative material that is used to treat decayed primary teeth. They are generally said to be superior to multi surface amalgam restorations and have a longer clinical lifespan than two or three surface amalgam restorations [(22), (20)]

SSC is mostly less used and it is less appreciated as restoration for primary dentition. It can be placed easily and quickly, while being durable and comparatively less expensive. It is less technique sensitive when it comes to placement and provides an advantage of full coronal coverage. These crowns have an advantage that they lack sensitivity to oral conditions during placement and cementation. This is often seen in uncooperative crying children where it is possible to place a well fitting crown without compromising the quality of restoration. But the main drawback of SSC is that it has a silver metallic appearance which is not aesthetic.

Types of Stainless steel crowns

- **Pretrimmed crowns**
- **Pre contoured crowns**
- **Preveneered crowns**

Indications for use in primary teeth [(23)]

Stainless steel crowns are the restoration of choice in the following situations:

1. Gross decay of primary teeth
2. Post pulp therapy procedures
3. Preventive restoration
4. Restoration of primary molars affected by generalized or localized developmental problems
5. As an abutment for a denture or space maintainer
6. Strong consideration should be given to the use of stainless steel crowns in children who require general anaesthesia for dental treatment.
7. Severe bruxism

Indications for use in permanent molar teeth [(24)]

1. As an intermediate restoration of a broken or traumatized tooth until a permanent restoration can be constructed, until eventual orthodontic treatment is done.
2. When finance is considered, permanent PMCs are useful as an economical restoration.
3. PMCs can be used in teeth with developmental defects. The crowns can be used to restore occlusion and reduce any sensitivity caused by enamel and dentin dysplasias in young patients.
4. Restoration of a permanent molar that requires full coverage

Advantages

1. Long lifespan, same as that of an intact primary tooth.
2. Provide protection to the residual tooth structure that would have been weakened after excessive removal of caries.
3. Less technique sensitive and less errors during placement.
4. Long-term cost effectiveness
5. Low failure rate.

Disadvantages

1. Unaesthetic metallic appearance.
2. Cannot be used partially erupted tooth

Open faced stainless steel crowns

The PMC is the most durable and most reliable restoration for a primary incisor that requires complete coverage but it is unaesthetic. To retain the strengths of PMC and improve the aesthetics of treated teeth, the dentist can cut away the cosmetically prominent part of the crown, remove adequate luting cement to leave retentive undercuts, and fill the void with bonded resin composite [(25)]

The success of open-face SSC is due to:

1. Firm bonding of resin to teeth tissue
2. Usage of dentin bonding
3. Phosphoric acid etching. A rough, porous structure is created on the remaining glass ionomer cement. Unfilled resin may infiltrate into this irregular, porous, hard surface, forming holding resin tags, and, hence, contribute to bonding [(25)].

Advantages

Improved aesthetics, unlike the plain metallic appearance of stainless steel [(26)]

Disadvantages [(26)]

1. Time consuming.
2. Metal margins can be seen.
3. Clinicians have to put up with control of bleeding during application of composite facings.
4. Short lifespan
5. Poor color stability under oral conditions

Preveneered Stainless Steel Crowns

Preveneered stainless steel crowns (PVSCCs) provide a potential aesthetic and durable restoration for grossly decayed primary teeth. These crowns are a combination of the durability of conventional SSC with the esthetics of composite resin. The facing materials available for these crowns are thermoplastic resin or composite resin bonded to the stainless steel crown. These aesthetic veneers are retained on the SSCs using a variety of chemical and mechanical bonding approaches [(18)] Initially preveneered crowns were developed for primary anterior teeth; later preveneered crowns for primary molars were developed. Commercially various types of PVSSCs are available and they differ in terms of shades, crown length, method of facing attachment to the SSC, and clinician's ability to crimp the crown [(27)]

Advantages

1. Aesthetically pleasing.
2. Durability
3. They give good results in conditions where moisture control is difficult.
4. Short operative time

Limitations

1. The addition of resin causes an increased thickness when compared to a conventional SSC, hence more extensive tooth preparation is needed for proper fit and occlusion [(18)]

2. No choice on the resin shade, and the given crowns are sometimes so white that they look artificial and unaesthetic in the mouth [(18)]
3. More expensive
4. The labial aspect of the margin cannot be crimped, because the bonded resin material will detach. The uncrimped area does not fit as precisely as a non veneered steel crown.
5. Cannot be sterilized under pressure with high heat, because it will destroy the attached resin layer.
6. Re-shaping of the resin veneers takes additional laboratory or clinical time.
7. Difficulty in placing crowns in patients with crowding.
8. When subjected to heavy force resin facing material is brittle and tends to break.

Strip Crown

They are seamless plastic crown forms without long cervical collars, manufactured by Space Maintainers Laboratory; 3M. Composite resin strip crowns are among the most esthetic and popular restorations used for decayed primary anterior incisors. These composite resin strip crowns have been used to restore carious primary teeth for over 20 years [(26)]. This is many clinician's first choice as it has superior aesthetics and it is easy to repair if any chipping off or fracture takes place. But the drawback is that it is the most technique sensitive option. These strip crowns serve as a matrix for reconstruction of composite in the anterior sector. Celluloid crowns were initially used for strip crowns, but now two other bonded alternatives are being used. The crowns help to 'seal' the underlying tooth from acid attacks and reduce the chance of developing further decay on the tooth.

Strip crown placement technique

1. Local anaesthesia (LA) is administered and teeth are isolated.
2. The teeth are prepared as for a crown to allow for the bulk of the resin in the final crown form. Incisally, the length of the crown is reduced using a high speed tapered diamond or tungsten carbide bur. Mesial and distal slices are cut tapering to a knife edge at the gingival margins.
3. Proper shade of the composite resin is chosen. This is done to achieve good esthetic results.
4. Selection of right size strip-crown forms.
5. Vent holes at the incisal-edge corners of the crown form and allow air to escape when it is filled with composite resin.
6. The crown form with composite resins is firmly seated on to the prepared teeth.
7. The composite resin is cured and using an excavator or probe the celluloid and the crown form is stripped off.
8. The cured crown is smoothed and polished.

Benefits [(28)]

- Patient pleasing
- Simple to fit and trim
- Removal is easy and fast
- Easy to repair
- Ideal for ankylosed tooth build-ups
- Easily matches natural dentition
- Leaves smooth shiny surface
- Easy shade control with composite
- Superior esthetic quality
- Crystal clear and thin celluloid crowns
- Large selection of size
- Cost-effective

- Better retention than polycarbonate crown
- Require removal of small amount of tooth structure
- Automatically contours restorative material to match natural dentition
- Strips off easily leaving a smooth surface
- Thin interproximal walls
- Sufficient strength
- Ideal for chemical or light-cured composites.

Disadvantages [(29)]

- Moisture or blood contamination affects resin bonding.
- Time consuming procedure in young and uncooperative child—adequate tooth structure required.
- Extremely technique sensitive.
- Not as durable or retentive as stainless steel/open faced crowns, pre-veneered crown or polycarbonate crown
- Not recommended on patients with a bruxism habit or a deep bite.
- Adequate moisture control may be difficult on an uncooperative patient.

Zirconia pediatric crown

Zirconia crowns provide excellent aesthetics because of their natural appearance and have been successfully used for permanent teeth for many years. These crowns were introduced in 2010, are comparatively new in the practice of pediatric dentistry and can be used for both anterior and posterior cases. It is unique and has the ability to resist cracking by transforming from one crystalline phase to another, and there is an increase in the resultant volume stopping the crack [(30)]. It has excellent biocompatibility, resistant to corrosion and high wear resistance [(31)]. In recent times, the zirconium dioxide ceramic prefabricated crown has been used to treat primary teeth. The tooth preparation for the zirconia crown will take longer than other preparations of teeth. Hence, this cannot be used in uncooperative children for long procedures. These crowns are difficult to adjust as they are ceramic in nature and cannot be trimmed with scissors like SSC. High speed fine diamond burs with a lot of water should be used due to excessive heat released that could cause fracture in the crown. It is not recommended to adjust occlusally and interproximally, as this will remove the glaze of the crown and create a weak area of thin ceramic. These crowns do not flex so therefore it is important that they fit passively, while attempting to seat it with force will lead to fracture. The crown should fit passively and completely, in a subgingival position without affecting the gingival tissue [(32), (33)]. Cementation is a concern as it is difficult to etch and bond due to lack of silicone in glass ceramic. Self-adhesive or conventional resin cements can be used as luting agents [(34), (35)]

These crowns contain no metal and are made of zirconia. They are one of the dominant types of ceramics used for various computer aided design /computer aided manufacturing restorations, including hand veneer/framework, framework/milled veneer, implant abutments, full-contour fixed prosthodontics and large implant-supported substructures. As of now it is the strongest dental ceramic available and is also esthetically pleasing. Some of the commercially available pediatric zirconia crowns are:

1. E Z Pedo crowns
2. NuSmile Zirconia crowns
3. Cheng Zirconia pediatric crowns
4. Kinder Zirconia pediatric crowns

Important considerations for proper seating of the ceramic crown

- (a) Adequate subgingival facial reduction
- (b) Complete removal of the cingulum area
- (c) Lingual and labial surface should meet at the thin incisal edge corresponding to the planned incisal edge of the final restoration. This thin incisal edge helps to decrease the internal interferences between the tooth and the internal surfaces of the crown.

Advantages

- 1. High-end esthetics,
- 2. Durability
- 3. Easy placement compared to composite restorations and strip crowns [(36)]

Disadvantages

- 1. It requires more time to prepare the tooth
- 2. Bleeding from the gum
- 3. Adjustment of crown is difficult
- 4. Inflammation or anxiety may hinder the setting of the cement used to bond the zirconia crown to the tooth (34)]

Conclusion

The article has brought together the different approaches for crowns in pediatric dentistry. Each approach and material carries its own advantages and disadvantages. There are many options to repair decayed teeth from stainless steel to its modifications to other crowns like strip crowns and zirconia crowns which are becoming popular. There is not sufficient data to suggest one type of restoration is better than the other, but dentists have been using many of these crowns successfully. Clinician's preferences, aesthetics, behaviour of the child, bleeding, moisture control are factors which affect the final decision of whichever crown is chosen.

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