REVIEW ARTICLE

ESTHETIC CROWNS IN PRIMARY DENTITION- REESTABLISHING THE INNOCENT SMILE

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ABSTRACT:
A problem commonly faced in day to day pediatric dental practice is the esthetic rehabilitation of a young toddler who has suffered multiple tooth loss subsequent to rampant early childhood caries or extensive dental trauma. A diversity of esthetic restorative materials is existing for restoring primary incisors. It is important to have knowledge of specific strengths, weakness, and properties of each material that will enhance the clinician's ability to make the best choice for each individual situation. Crowns available for restoration of primary incisors consist of those that are directly bonded onto the tooth, which normally are a resin material, and those crowns that are luted onto the tooth and are some type of stainless steel crown with esthetic value. Many options exist to repair carious primary incisors, but there is insufficient clinical data to recommend that one specific type of restoration is superior to another. Operator preferences, esthetic demands by parents, the child's behavior, and moisture and hemorrhage control are all variables which have an effect on the decision and definitive outcome of whatever restorative treatment is chosen. A variety of esthetic options are available for maxillary primary teeth but a few are available for mandibular primary teeth owing to its small size and closeness to the pulp chamber. This article includes the description of various available options for the restoration of primary anterior teeth, which would help a clinician decide for the right type of full coverage restoration.
Keywords- Esthetics, Full coverage restorations, Deciduous teeth

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INTRODUCTION:

Esthetics is the science of beauty: that particular detail of an animate or inanimate object that makes it striking to the eye. In the recent times, well contoured and well aligned white teeth place the customary for beauty. Such teeth are not only considered eye-catching, but are also indicative of nutritional health, confidence, hygiene and economic class. With the growing receptiveness of the available esthetic options, there is a superior requirement for the solution to displeasing problems such as nursing bottle caries, malformed and discolored teeth, hypoplastic defects, tooth fractures and bruxism in children.

One of the most challenging tasks is to restore the grossly decayed primary incisors, particularly in the very young child. Due to the small size of the teeth, nearness of pulp to the tooth surface, fairly thin enamel, issues associated to child behavior and finally expenditure of the treatment, restoring the primary teeth is a big challenge. 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 esthetic restoration. Primary teeth have a definitive life span of only 6-8 years so a restoration should last at least, without requiring major upholding. Thus a thorough knowledge is very important from a clinical point of view to

know the efficacy of various esthetic crowns available.[1]

The indications for full coverage restorations are:

- Caries on multiple tooth surface
- Extensive cervical decalcification
- Endodontically treated anterior teeth
- Traumatized anterior teeth
- Multiple hypoplastic defects or developmental disturbances on anterior teeth
- Discolored anterior teeth

This article further focuses on various esthetic crowns available for primary anterior teeth and their importance from clinical point of view.

CLASSIFICATION

Based on method of cementation to tooth

- Bonded crowns – polycarbonate crowns, strip crowns, pedo jacket crowns, Artglass crowns
- Luted crowns – stainless steel crowns with facing , Kinder Krowns , Cheng crowns, Nu-Smile crowns, Dura crowns, Whiter Biter crowns, Pedo Compu crowns, High density polyethylene veneered crowns

Based on the material of the crowns

- Polymer – polycarbonate crowns, strip crowns
- Pre veneered stainless steel- Nu- smile Signature
- Zirconia – EZ pedo, Nu-Smile ZR
- Aluminium veneered with tooth colored material – Pedo pearls

DESCRIPTION

1. Open faced stainless steel crowns

Stainless steel crowns are most long-lasting, cost-effective and reliable for restoration rigorously carious and primary incisors that are fractured. They can be easily placed, resistant to fracture, resistant to wear and continue to attach firmly to tooth until exfoliation. However there is a compromise in esthetics due to the unpleasant silver metallic appearance. Thus various modifications have been adopted to enhance its use in primary anterior teeth.[2] It was introduced by Hartmann in 1983.[3]

Stainless steel crowns can be modified for its use in the anterior teeth by an open faced stainless steel crown. For this a 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 fair and provides the advantage of the strength of preformed stainless steel crowns. However the placement of crown is time taking as it involves two-step process.

Advantages : [1]

- Economical
- Robust
- Easy to use
- Well adapted to tooth
- Esthetically pleasing

Disadvantages: [1]

- Gingival hemorrhage or moisture is present or cannot be controlled,
- Difficult to manage saliva and blood contamination while composite facing is done
- Increased chairside time
- Metal may show at the gingival margin of the crown

Weidenfeld et al[4] stated that chairside veneering technique is successful in restoring severely damaged anterior teeth and the veneering maintains adaptability, strength and gingival contour with better cosmetic effect.

2. Pre veneered stainless steel crowns

Crowns manufactured with composite resins and thermoplastics bonded to the metal are pre veneered stainless steel crowns. They served to be a suitable, strong, unfailing, and esthetic solution to the complicated challenge of restoring severely carious primary incisors. The various available pre veneered crowns are Cheng crowns, Kinder Krowns, Nu-Smile crowns, Dura crowns.[2]

a.) 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.[3] They are natural-looking, stain-resistant crowns and are available for both the right and left centrals, laterals as well as cuspids.[5]

Advantages:[3]

- One visit procedure
- Less technique sensitive
- Most accepted crowns
- Can be autoclaved
- Economic
- Stain resistant
- Does not cause any wearing of the opposing tooth

Disadvantages:[3]

Veneer may fracture while crimping

Baker et al[6] conducted a study to evaluate the amount of sheer force necessary to fracture, dislodge or deform the esthetic veneer facing of commercially available veneered primary crowns. They concluded that Cheng crowns showed statistically significant results compared to all the other available crowns.

b) Kinder Krowns

Kinder crowns have the most natural shades and contour existing for the pediatric patient. The great intensity and vitality from the lifelike composite divulge a natural smile without the bulky "Chicklet" look of other restorations. They are available in 2 shades i.e Pedo 1 and Pedo 2. Pedo 2 shade is the most natural shade[1]. While Pedo 1 shade is for those cases where bleached white tooth color is required. Kinder Krowns can be used in fixed bridge fabrication for replacing lost primary central incisors. These crowns also have an additional mechanical retention called as IncisaLock. It provides better retention and more space for composite, which makes it strong without the need for sacrificing much of tooth structure[1].

Nu Smile crowns

NuSmile crowns have the most natural looking veneer facing. They can undergo heat sterilization without any significant effect on the bond strength and color. Available in 2 sizes i.e regular and large for centrals, laterals and canines. They have facing only on the labial side, allowing crimping possible only on the lingual side[5].

Advantages :[3]

- Natural looking crowns
- Autoclavable
- Good esthetics
- Increased longevity
- Patient- parent's satisfaction
- Less chairside time
- Will not discolor

Disadvantages :[3]

- Poor gingival health
- Costly
- Bulky
- Crimping may lead to fracture

MacLean et al[7] concluded that Nu Smile crowns are the most clinically successful full coverage restorations for the anterior primary teeth with severe decay.

b.) Dura crowns

Dura crowns are high density polyethylene veneered crowns. They can be crimped both on the gingival facial margin as well as the lingual margin. They can be easily festooned and easily trimmed with crown scissors. It has got a full-knife edge. These crowns are available in a single shade.

Though these crowns provide better esthetics, but they have a few disadvantages to mention. Crimping of the metal portion will weaken the aesthetic facing and may lead to premature failure. Instead 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. Also it requires a lot of tooth reduction prior to the placement of the crown. Hassan et al stated that sizes and shades of pre veneered stainless steel crowns are also a major problem[8].

Guelmann et al[2] reported that Dura Crown, Kinder Krown, and NuSmile crowns were significantly more retentive when crimping and cement were combined than the non veneered crowns. Gupta et al[9] concluded that veneer resistance to fracture for NuSmile crimped crowns was comparable to non crimped crowns. The crimped crowns, however, were associated with greater veneer surface loss.

c.) Whiter Biter crowns

Whiter Biter crowns are preveneered stainless steel crowns which have a polymeric coating with a polyester/epoxy hybrid composition[3]. The coating is very thin but it does not peel or chip under normal use and mastication. Roberts et al[10] found that 32% of the crowns lose some of the esthetic white facing.

d.) Pedo Compu crowns

Pedo Compu crowns are stainless steel anterior crowns with high quality composite facing and mesh based with a light cured composite crown. They are color stable and plaque resistant[1,3].

Advantages:

- Does not wear the opposing tooth
- Color stable
- Natural appearance

e.) High density Polyethylene veneered crowns

Esthetic preformed crowns which are veneered with high density polyethylene that is thermoformed over a preformed stainless steel crown.

Advantages:[3]

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

c) Pedo Pearls

Pedo Pearls are metal crowns coated with epoxy resin, which serve as permanent crowns for primary teeth. The difference was that the metal used was aluminum in place of stainless steel. The epoxy resin coating adheres better with aluminum surface rather than stainless steel. Available in universal size and can be used on any side. This was first introduced in 1980.

However, the aluminum crowns are quite soft and which may create a problem with long-term permanence. Likewise in the areas of heavy occlusion, there is usually wearing off of the white coating [3]. In spite of these problems they offer, these crowns can be easily placed of all the crowns with reasonable esthetics.[1]

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 patched up with more composite. Pedo pearls crowns should be avoided in the patients with a history of bruxism.[3]

d) Strip crowns

It is the most frequently used and esthetic of all the available restorations for the treatment of decayed primary incisors. These crowns are filled with composite resin and bonded on the tooth to be restored.

The benefits of these crowns include[3]

a) Parent/patient are usually satisfied
b) Ideal for the build-up of ankylosed tooth
c) Simple to fit & trim
d) Removal is fast & easy
e) Easily matches natural dentition
f) Leaves smooth shiny surface
g) Easy shade control with composite
h) Superior esthetic quality
i) Ideal for photo cure
j) Crystal clear and thin
k) Large selection of size
l) Easy to repair

The crowns help to seal the underlying tooth from acid attacks and reduce the chance of further decay on the tooth. The success rate depends on how much amount of sound tooth is available for the placement of the crown[1].

Indications:[3]

- 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

Contraindications:[3]

- Insufficient tooth structure for retention
- Deep overbite
- Bruxism
- Periodontal diseases

Margolis FS[11] describes the use of strip crowns as relatively easy technique which produces beautiful outcome in relatively short time. Ram & Fuks et al[12] observed a success rate of resin composite strip crown with a 2 yr follow up and concluded that strip crown is an esthetic modality with a satisfactory means of restoring carious primary incisors. Kupietzky & Waggoner[13]

assessed parental satisfaction for composite strip crowns and concluded that parents were satisfied with the crowns regardless of the color, size or overall appearance. However they were not satisfied when asked about the durability of strip crowns. Though these crowns are widely accepted by patients, the chances of its failure are more. The reasons for this maybe due to technique sensitive procedure, adequate tooth structure is required and any lapse in patient selection, moisture and blood loss control, tooth preparation and placement of resin.

e) Polycarbonate crowns

Polycarbonate crowns are acrylic resin crowns for restoration of primary anterior teeth. It is esthetic than stainless steel crowns, easily trimmed and can be adjusted with pliers. The crowns can be crimped because of its flexibility. It is available in a universal color i.e translucent cement shade[1]. These crowns cannot resist the strong abrasive forces thus leading to occasional fractures; thus it is contraindicated in cases of severe bruxism and deep bite[3].

f) Artglass crowns

Artglass is a polymer glass which provides a natural feel, bond ability associated with composite but esthetics and longevity of porcelain. It is a bifunctional and multifunctional methacrylates which forms a three dimensional molecular network with highly cross-linked structure. Due to such structural nature of the crown they are also known as "organic crowns". It consists of 55% microglass and 20% silica filler[3].

Benefits of the crown

- Esthetics same as natural dentition
- Durable
- Wear is similar to enamel
- Inorganic filler particles provide color stability and make them plaque resistant
- Flexural strength is over 50% higher than porcelain
- Can be easily adjusted or repaired intraorally
- Ease and bondablitiy of a composite.
- Requires minimum chairside work

g) Pedo jacket crowns

Pedo jacket crowns are made up of a tooth-colored copolyester material, which is filled with resin material and left on the tooth after the polymerization instead of being removed as it is done in strip crowns. These crowns are available in only one shade, which is very white, so matching the up adjacent, non restored teeth can be hard. Also, because the crowns are made of copolyester, so they cannot be trimmed or reshaped with a high-speed finishing bur which may lead the material to melt to the heat produced by the bur.[1]

Advantages:[3]

- Crown placement can be completed in a single sitting
- Cost effective
- Multiple adjacent restorations with minimal tooth reduction
- Crown will not split, stain or crack
- Can be trimmed with scissors

Disadvantages:[3]

- Available in a single color so shade selection is difficult
- Cannot be reduced by using high speed finishing bur

h) Zirconia crowns

It was introduced by John P Hansen & Jeffery P Fisher in 2010[3].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.[14]

EZ crowns are the first manufactured zirconia crowns. 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.[3] Ashima et al[15] reported a case of a 4 yr old boy with discolored upper anterior teeth. They used zirconia crowns as it provides tooth like esthetics and strength close to available metal crowns. They concluded that zirconia crowns are simple and efficient and represents a hopeful alternative for rehabilitation of severely decayed or fractured primary anterior teeth. 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.[16]

i) Cerec crowns – All ceramic 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.[3]

Advantages

- Single visit
- Time saving
- No temporization required
- Improved esthetics
- Very durable

Disadvantages

- Very expensive
- Requires extra training on the dentist's part to know the technology

j) Biologic crowns

It is a technique in which fragment reattachment using natural teeth is done and it is known as biologic restorations. It meets the esthetic as well as standards of natural teeth. This procedure was published as a case report first 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.

Benefits

- Natural esthetics
- Superficial smoothness and cervical adaptation compatible to surrounding teeth
- Avoids long clinical appointments
- Avoids laborious techniques
- Inexpensive

Limitations

- Lack of patient acceptance
- Lack of availability of teeth with similar structure, texture and color
- Longevity is poor[3]

Sanches et al[17] evaluated the biological restorations as a treatment option for primary molars and found that it provided a good alternative to other esthetic restorative options.

CONCLUSION

The pedodontist has a wide array of esthetic crowns available for restoring primary anterior teeth. But majority of 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 drawbacks of these crowns are that a few crowns are expensive and cannot be provided to the patients belonging to lower socioeconomic strata of the society. The beauty of the esthetic crown will depend on the clinician's knowledge, child's behavior, and retention of the crown and proper maintenance of the oral hygiene.

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