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Zirconia Crowns In Pediatric Dentistry: A Review

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Abstract: Esthetic dentistry is the marriage between the "art and science of dentistry". Esthetic dentistry deals with all disciples in dentistry. Dental caries is one of oldest and most common diseases found in children as well adults. Behavioural, psychological and social factors play a significant role in the disease progression. The newly introduced esthetically accepted zirconia crowns are promising alternative to other restorative materials and crowns in pediatric dentistry.

Introduction: Esthetic dentistry deals with almost all disciplines in dentistry. It's basically "Perception of beauty". Early childhood caries commonly affects the primary anterior teeth in young age group children who requires esthetic management. In society like today the demand for esthetic approach in pediatric dentistry is increasing. Parents are more concern for esthetics of their child and tooth colored restorations are prime concern for the parents.
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A healthy smile essential for speech, mastication and ultimately improves self-esteem of the child. The early loss of primary anterior teeth leads to reduced masticatory efficiency, loss of vertical dimension, development of para-functional habits including tongue thrusting, and speech problems.[1]Crowns are routinely used in the clinical practice of pediatric dentistry. Traditionally, it has been used for restorative purposes often affected by caries, after endodontic treatment of teeth, decalcification, and developmental defects.[2] Mean while; various types of crowns are used in pediatric dentistry such as stainless steel crowns, strip crowns, Art glass crowns, polycarbonate crowns, etc. The choice of full coverage restorations for

primary teeth must provide an esthetic appearance in addition to restoring function and durability.[3]

Zirconia crowns: There are many esthetic options that have been available over the years each having its own advantages, limitations, and associated technical issues.[4] Prefabricated zirconia crown is an eventually strong ceramic crown and provides more esthetic and biocompatible full coverage for primary incisors and molars.[5]Pediatric zirconia crowns were introduced by EZ-pedo and became commercially popular in 2008. Later preformed zirconia crowns were introduced by companies like Nusmile, Kinder krowns, Cheng crowns, Signature crowns and many more. They are anatomically contoured, metal-free, completely bio-inert, and resistant to decay.[6] The most common oxide of zirconium is zirconium dioxide (ZrO2), commercially known as Zirconia which is a crystalline, clear to white-colored solid that has an especially high fracture toughness and chemical resistance in the cubic form. Routinely there are three types of zirconia that are currently used in dentistry; tria-stabilized tetragonal zirconia polycrystal (Y-TZP), magnesia partially stabilized zirconia and zirconia toughened alumina. A tetragonal zirconia polycrystal (TZP) which is Yttrium-stabilized zirconia commonly used in pediatric dentistry.[7]

Properties of Zirconia: Zirconia has similar mechanical properties to stainless steel. Its resistance to traction can be as high as 900-1200 MPa and its compression resistance is about 2000 MPa.[8] Zirconia is a polycrystalline ceramic without glass components that occurs in three forms namely, Monoclinic - pure zirconia stable at 1107 ^{0}C; Tetraclonic – above 1107 ^{0}C and Cubic face – at 2370 ^{0}C

Under the large stress, Zirconia undergoes ready to cracks because of higher volumes of expansion. It can be reduced by adding a small amount of Yttria, hence the resulting material has high compressive strength, and high fracture resistance, corrosion resistance, durability, and biocompatibility. The density of zirconia is 6.05 gm/cm^3 and the hardness is 1200 HV. Compressive strength is 2000 MPa and fracture toughness is 7-10 MPam$^{1/2}$ respectively.[9]

Indications of Zirconia Crowns

- Multi-surface caries
- Caries involving incisal edges
- Fractured teeth with proximal surface
- After pulp therapy
- Discolored anterior teeth
- Nursing bottle caries

Contraindications of Zirconia Crowns

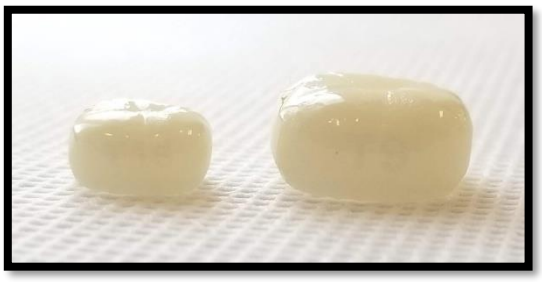
- Crowding of teeth
- Gingival inflammation surrounding the tooth
- Bruxism

Commercially available Zirconia crowns:

Nu smile Zirconia (Zr): It is made up of high-grade monolith Zr ceramic. It

has increased durability with strength more than enamel. The translucency of Zr ceramic provides excellent esthetics and prevents the problem of dark tooth showing through pulpally treated teeth. It is also provided with a Nusmile try-in crown to check fitting prior to final cementation. This feature not only saves the clinician's chair side time but also eliminates extra steps and disinfection of the crown. Nusmile zirconia crowns have improved marginal adaption to the tooth and are smaller at the cervical crevice than the other brands.

Kinder crowns Zirconia: It is based on Nano technology, produces most consistent, high quality zirconia. It has polished surface to reduce opposite enamel wear. It has internal retention system which locks the restoration after cementation. This retention bands also provide with additional surface area for bonding. Fine feathered margin of zirconia kinder crown makes the emergence profile for the crown as natural as possible. It is available in two sizes: Midsize and Regular size. Mid-sizes are designed for first and second primary molars to alleviate seating issues in situations when you are placing crowns back to back or when your patients have experienced major space loss. The mid-sized crowns hold their bucco-lingual width, and at the same time as the mesio-distal width has been reduced to allow for easier placement and positioning.



EZ Pedo Crowns: It comes with the patented retention technology "**zir – lock ultr**'' i.e. retentive grooves which extent all the way to the crown margins, preventing cement washout. It also prevents entry of harmful bacteria and moreover it provides two times more surface area for bonding. Additional retention is provided through blasting with Aluminum oxide.

Kids-e-Crown: These crowns are available in two kits i.e. anterior and posterior crown kit. The posterior crowns have inner flat occlusal table with uniform axial walls. There are micromechanical boxes for retention. The wall thickness is 0.3 mm and margins are 0.2 mm. The sizes for anterior crowns ranges from 0-5 and in posterior, there are five regular sizes 2-6 and three narrow sizes 3-5. The narrow sizes are mid-sizes with broader bucco-lingual dimensions for proximal lesions and space loss cases. The labeling of the crowns is permanently embossed inside the crown.

Signature crown: It has 0.2 mm feather edge margin and 0.5mm overall thickness. Posterior crowns have flat disto-proximal wall of primary first molar and mesial flat proximal wall of primary second molar with no narrow crowns. In anterior, both universal contoured and left/right side options are available. There are 1-6 posterior and 1-4 anterior sizes with no space loss crowns as Kidz-e crown.

Preparation of tooth: Tooth preparation for zirconia and cementation of crown are crucial clinical steps in zirconia placement. Adequate clearance, proper angulations, and clinically visible knife edge finish lines helps to preserve gingival health and accumulates less amount of plaque. Adequate tooth preparation helps to improve esthetics significantly; proper crown fit reduces chances of veneer fracture and saves chair time. The tooth preparation should be such that crown fits the tooth passively without using pressure.

Anterior Crown technique:

Procedure

Crown selection: Select appropriate size of crown by measuring mesiodistal width with vernier caliper or simple divider.

Tooth preparation:

Incisal reduction: Reduce 1.5-2mm incisally using donut shape bur following the incisal plane.

Figure 1: Incisal Reduction

Supra-gingival reduction: Make a chamfer finish line of 0.5- 1 mm on all four sides of crown. Equi-gingival margins using chamfer bur. Supra-gingival reduction using a taper bur, remove the chamfer finish line going 1-2 mm sub-gingival making a feather edge or no finish line.

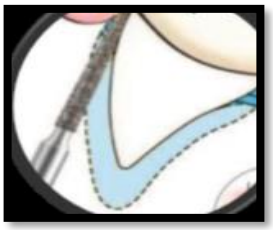


Figure 2: Subgingival Reduction

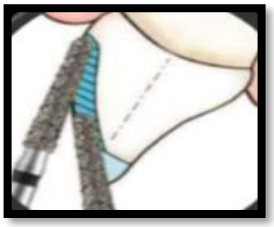


Figure 3: Supragingival Reduction

Check fit and bleeding control: Check for passive fit of selected crown. Control bleeding using pressure or hemostat. Clean the crown under tap water and with alcohol to remove blood and saliva.

Posterior technique

Procedure

Crown selection: It can be done by using mesio-distal dimension of the corresponding tooth with the help of divider. This is done by holding a crown up to their existing tooth or considered the mesio-distal dimension and selected the crown size to be used based on the original size of the tooth. Alternatively, a digital x-ray system that may pre-size the crown by taking measurements in software and match patient's interproximal width to the corresponding crown size.

Figure 4: Crown Selection

Local anesthesia is applied prior to the tooth preparation.

Occlusal preparation: Using the marginal ridge of the adjacent teeth as a reference point, 1.5–2 mm of occlusal reduction is performed. An adequate occlusal reduction is extremely important for the proper fit and placement of pediatric zirconia crowns. The final occlusal plane of the seated pediatric zirconia crown is determined by the amount of occlusal reduction. For occlusal reduction, it is recommended using a coarse grit wheel diamond bur (1.2 mm).

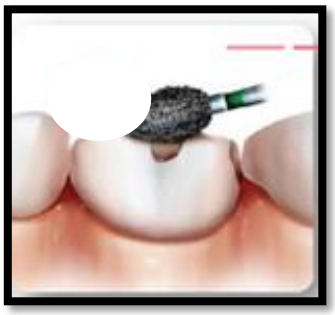


Figure 5: Occlusal Reduction

Bucco-Lingual Reduction: Reduce bucco-lingual wall approximately 1-1.5 mm using a flame-shaped diamond bur. During bucco-lingual reduction, keep the bur parallel to the tooth. Keeping the bur parallel to the tooth ensures consistent reduction from the occlusal down to the gingival tissue.

Figure 6: Bucco-Lingual Reduction

Interproximal Reduction: Inter-proximally 1mm is reduced using a flame shaped diamond bur, such as a .368 or .330 tapered carbide. During interproximal reduction, keep the bur parallel to the tooth and remain supra-gingival. This technique reduces the likelihood of contacting the pulp.

Feather Margin: Using a flame-shaped diamond bur reduces sub-gingivally 1-2mm, ending with a feathered margin. Often there is a remaining band of tooth structure, just below the tissue - removing that tooth structure is the key to achieving a passive fit.

Figure 7: Feather margin

Trial Fitting: The most important key to remember when placing Zirconia is that a passive fit is required. Zirconia are solid ceramic and do not flex. If the crown won't go into place without resistance, there is need to reduce more tooth structure. The appropriately sized crown will seat passively and sub-gingivally 1-2 mm and should not alter the gingival tissue.

Cementation: The tooth and the crown are cleaned of all blood residues. Hemostasis of the gingiva is obtained via pressure applied with a finger. A resin cements or dual cure resin cements should be used for the cementation.

Advantages:

- High strength and toughness
- Can withstand wear and tear
- Translucent sufficient to be comparable to natural teeth
- Less tooth removal
- Modifiable size, shape and color
- Biocompatible
- Good patient acceptance

Disadvantages of Zirconia crown:

- Zirconia crowns cannot be crimped like stainless steel crowns.
- Due to inflammation, gingival bleeding may hinder the cement set to bond the zirconia crown to the tooth.
- They are expensive compare to other crowns.

Zirconia crowns are sterilized by autoclave[10] and other methods like sandblasting, sodium hypochlorite or cleaning solution such as Zirclean (BISCO) OR Ivoclean (Ivoclar Vivadent). Zirconia crowns fulfill excellent esthetics, full inclusion of the treated or carious tooth, no parts of the crown that may debond, and a less delicate procedure for cementation contrasted with a resin strip crown.[11] Resin based luting cements are used for cementation of zirconia crowns. Salivary contamination of the crown during try-in of cementation may weaken the bond to the resin cement.[12] Failure of the zirconia crown is noted when zirconia crowns are improperly polished from manufacturer and only glazed can be destructive to the opposing tooth structure.[13]

Conclusion

1. With the above literature it is evident that every crown used to treat children has its own advantages and disadvantages. Survival time variation may also be closely related to the differences in treatment decision by the dentist, who can adopt a proactive or a reactive position in relation to dental intervention and this becomes critical especially while attending children.
2. Various factors like longevity of crowns, retention of crowns depends on dental material properties, operator ability, age of the patient and co-operation of the child to accept the treatment.
3. To conclude, pre-fabricated zirconia crowns are retentive, esthetically acceptable by both parents and children. It is expensive compare to other crowns used in Pediatric dentistry.

References:

1. Wyne A, Darwish S, Adenubi J, Battata S, Khan N. The prevalence and pattern of nursing caries in Saudi preschool children. Int J Paediatr Dent 2001; 11:361-4.
2. American Academy of Pediatric Dentistry. Guideline on pediatric restorative dentistry. Pediatr Dent2013;35:226-34.
3. Chadha T, Yadav G, Tripathi AM, Dhinsa K, Arora D. Recent trends of Esthetics in Pediatric Dentistry. Int J Oral Health Med Res 2017; 4(4):70-75.
4. Sahu AK, Patil RU, Kambalimath HV, Asokan A, Maran S, Jain S. Spectrum of choices to restore the smile of a child: An update on current pediatric anterior crowns. J Dent Allied Sci2016; 5:25-9.
5. Lee JK. Restoration of primary anterior teeth: review of the literature. Pediatr Dent. 2002; 24(5):506-10.
6. B Amrutha. Tooth Coloured Crowns in Pediatric Dentistry- A Review. Int. J. Curr. Res. 2019;11(5):4098-104.
7. Christel P, Meunier A, Heller M, Torre JP, Peille CN. Mechanical properties and short-term in-vivo evaluation of yttrium-oxide-partially-stabilized zirconia. Bio. Material Res. 1989; 23:45–61.
8. Piconi C, Maccauro G. Zirconia as a ceramic biomaterial: A review. Biomaterials 1999; 20:1-25.
9. Larsson C. Zirconium dioxide based dental restorations. Studies on clinical performance and fracture behaviour. Swed Dent J Suppl2011;213:9 84.
10. Ram D, Fuks AB, Eidelman E. Long-term clinical Performance of Esthetic Primary Molar Crowns. Pediatr Dent.2003;25:582-584
11. Fuks AB, Ram D, Eidelman E. Clinical performance of esthetic posterior crowns in primary molars: a pilot study. Pediatr Dent 1999;21:445-8.
12. Yang B, Lange-Jansen HC, Scharnberg M, et al. Influence of saliva contamination on zirconia ceramic bonding. Dent Mater 2008;24:508-513.
13. Chen L, Suh BI, Brown D, et al: Bonding of primed zirconia ceramics: Evidence of chemical bonding and improved bond strengths. Am J Dent 2012;25:103-108