

# Pediatric Zirconia Crowns—A Satisfactory Esthetic Solution: A Review

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## ABSTRACT

A variety of esthetic restorative materials are available in dentistry for restoring primary teeth. Each has its own advantages and disadvantages. Complete coronal restoration of primary teeth with esthetic satisfaction of the patient is a significant concern. Pediatric zirconia crowns are commercially available on the market for complete coronal restoration. This paper reviews the published data on zirconia crowns for primary teeth.

**Keywords:** Cementation, Esthetics, Zirconia.

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## INTRODUCTION

More esthetic demand of the parents and patients to restore the decayed and damaged primary teeth has led to the availability of different esthetic preformed crowns. For pediatric dentists, the esthetic rehabilitation of severely damaged deciduous teeth is one of the most significant challenges.<sup>1</sup> Caries in very young children, known as early childhood caries (ECC).<sup>2</sup> Because of the aggressive nature of ECC, areas of demineralization and hypoplasia can quickly foster cavitation. If untreated, the disease process can soon involve the dental pulp, promoting dental infection and promoting dental disease potentially perilous fascial space involvement. Such conditions might bring a health-related crisis requiring hospitalization, antimicrobial agents, and sometimes may require extraction of the culpable tooth in the oral cavity.<sup>3</sup>

Maintenance of tooth structure, the durability of the restoration, and parental satisfaction are significant considerations. In recent years, technological advancements in dental materials for children have necessitated reassessments of new treatment options. Various approaches for full-coverage restorations have emerged in pediatric dentistry.<sup>4</sup>

EZ-Pedo (EZ-Pedo, Loomis, CA, USA) was the first pediatric zirconia crown commercially accessible in the United States, found by Dr John Hansen and Dr Jeffrey Fisher in 2008.<sup>1</sup> As of late, Zirconia esthetic crowns showed up on the lookout. Zirconia is a crystalline dioxide of zirconium that has mechanical properties like those of metals, and its shading is like that of teeth. Prefabricated primary zirconia crowns are currently accessible for both primary incisors and molars.<sup>3</sup>

Zirconia has been utilized effectively for more than 10 years in adult dentistry. This material has been adjusted for pediatric dentistry to give a more challenging and esthetic option.<sup>5</sup> There is a recent surge in the use of all-ceramic restorations in pediatric dentistry, which has led to the development of zirconia crowns by multiple brands (NuSmile, Kinder Crowns, Cheng Crowns).

Zirconia crowns are also known as ceramic steel.<sup>6</sup> This type of crown has improved esthetics due to the lack of a metallic base. These crowns are visibly thicker than Stainless steel crowns, cannot be modified in any way. The manufacturer recommends passive seating when cementing. These crowns are thicker and require more aggressive Preparation.<sup>7</sup> Nowadays, parents are the ones who are the decision-making authority for children and more importance

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toward esthetic restorations. In addition, children themselves prefer tooth-colored restorations.<sup>5</sup>

The purpose of this article is to review the pediatric zirconia crowns available for restoring the primary incisors and molars (Table 1). To improve the clinician's ability to settle on an ideal choice of crowns for each tooth and patient's satisfaction toward the esthetic crowns.

## MATERIALS AND METHOD

The literature review was done with a background to compare the studies that have been done about pediatric zirconia crowns in dentistry. The review was conducted using electronic databases Google Scholar and PubMed.<sup>8-15</sup> The articles were published in English from 2013–2021, compared with other crowns available in dentistry. The search strategy involved using the following keywords: cementation of preformed zirconia crowns, esthetic crowns in dentistry, review of pediatric zirconia crowns. The articles were then selected and screened for relevant studies. The full texts of relevant studies were read independently to exclude the studies which were not eligible.

### Fabrication of Pediatric Zirconia Crowns

Primary zirconia crowns, namely NuSmile, EZcrowns, Cheng crowns, and Kinder crowns. Each brand has an alternative cycle of assembling and completing the crowns. All four commercially available primary zirconia crowns have different surfaces<sup>16</sup> and are available in different sizes (Table 2).

**Table 1:** Review of literature

Author	Year	Results
Janice A Townsend, et al.	2013	The force required to fracture stainless steel was greater than that required to fracture a zirconia crown. <sup>7</sup>
T. Walia et al.	2014	Zirconia crowns are retentive, biocompatible, and cause low-grade abrasion at the 6-month follow-up. <sup>8</sup>
Danial M Holsinger et al.	2015	Zirconia crowns are a clinically appropriate restoration for the primary maxillary anterior teeth. <sup>5</sup>
Manar Zaki Al Shobber et al.	2017	NuSmile zirconia crowns demonstrated the best fracture resistance even under heavy, heavy pressure load strain. <sup>9</sup>
Lin Jing, DMD, et al.	2018	The retention force of prefabricated zirconia crowns is proportional to occluso-cervical heights and requires two millimeters of OCH. <sup>10</sup>
Hyeonjong Lee, et al.	2019	SSCs require less tooth reduction than posterior zirconia crowns. <sup>11</sup>
DrGay-athri murali et al.	2020	When esthetics is of prime concern, preformed zirconia crowns can be an option for posterior complete coronal restoration. <sup>12</sup>
Mohammad Hassan Hamrah, et al.	2021	According to studies, parental and child satisfaction with zirconia crowns with clinically acceptable restorations in the primary maxillary incisors is considerable. <sup>13</sup>

### NUSmile

NuSmile uses a proprietary injection-molded, sintered system with hand smoothing followed by mechanical polishing that results in a smooth surface with lower roughness average values.<sup>16</sup>

Patented injection molding conveys extraordinary properties impractical with different brands—uniform particle size for strength, exceptionally retentive intaglio bonding surface, knife-edge margins, and negligible crown thickness.<sup>17</sup>

### EZCrowns

EZCrowns are polished on the occlusal, lingual, and glazed on the facial surfaces.<sup>16</sup>

### Manufacturing of EZCrowns

The zirconia crowns are first milled in a custom-made machine. About 35 to 50 crowns placed in a disk can form all the while. From that point, the crowns will be smoothed, polished, put through a staining solution, hardened in a 4000-degree chamber, micro-blasted and glazed. Each crown gets a mark, which a dental specialist can scratch off before arrangement. There are 96 shapes and up to six sizes for each particular tooth. Zirlock technology has been implemented within the EZ-Pedo crown to improve retention.<sup>18</sup>

### Kinder Krowns

Zirconia Kinder Krowns® diverse is the intaglio. Organizations add screw-like threads to the crown walls during the assembling interaction, which precisely bond the tooth's restoration. These threads additionally increase the surface region for the cement to synthetically attach to the crown. The chemical bond to ceramics, in general, is frail; it is imperative to incorporate mechanical retention. Vital contrast of Zirconia Kinder Krowns® critical advance of the permits using glass ionomer cement and the actual crown for

intraoral attempt try-ins. It saves significant stock and chairside time.<sup>19</sup> Kinder Krowns are polished on the lingual surface and glazed on all other surfaces.<sup>16</sup>

### Cheng Crowns

Cheng crown uses a proprietary six-step polishing technique and hand-finishing of each crown after the milling process with mirror-like smart satin polishing on all surfaces. For both primary first and second molar, Cheng crowns had the smoothest occlusal surface and occlusal margins.<sup>16</sup>

### Advantages and Disadvantages of Pediatric Zirconia Crowns

Zirconium is exceptionally biocompatible and does not cause allergic symptoms to human beings. Other significant advantages of Zirconium dioxide over other ceramics include:

- Hygienic: Zirconia holds less plaque, resulting in healthier gums
- Esthetics: The benefit of zirconium as a foundation for a tooth replacement is its brilliant and white tooth-like color. The white color of Zirconium dioxide also eliminates the possibility of a darkened gum
- Strength: Zirconium is the second most robust material found in nature (next to diamond).
- Biocompatible: Zirconium is inert, and subsequently, it does not bring on any unfavorable susceptible responses. In addition, it shows phenomenal sturdiness and obstruction against wear and tear.<sup>20</sup>

The success of a dental restoration depends upon several factors, such as the material chosen, its mechanical properties, anatomical form, surface texture, translucency, and color.<sup>21</sup>

Prefabricated zirconia crowns require significant removal of enamel and dentin substance during tooth Preparation to accommodate their rigid structure and seat them passively. On average, Clark et al. found that 18% of the total mass was removed during zirconia crown Preparation in typodont teeth. This mandatory drawback has been raised as a concern by the researchers, who note inadvertent pulp exposure and the postoperative problems of pulpal inflammation as other disadvantages.<sup>4</sup> Zirconia has exhibited high wear resistance, brilliant biocompatibility, and prevalent corrosion resistant. The most apparent benefits of zirconia crowns are their brilliant esthetics, far better than other pediatric crown choices. Some disadvantages that limit the utilization of zirconia crowns are that it requires more opportunity to set up the tooth to fit the crown. Due to inflammation, gingival bleeding may hinder the cement set to bond the zirconia crown to the tooth. Nevertheless, with most recent developments makes are attempting to limit these components. EZ Pedo has presented Zir-Lock ultra, mechanical undercuts to expand crown retention. Another highlight is that zirconia crowns not contaminated with blood or salivation have a better bond to cement and take care of this issue; NuSmile came up with the try-in pink crown.<sup>22</sup> The execution of prefabricated zirconia crowns is not liberated from constraints and disadvantages. The last may require a more prominent measure of tooth reduction, while their expanded hardness may prompt tooth wear of the antagonist's teeth.<sup>23</sup>

Zirconia crowns fulfil 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. Nevertheless, still, there are significant disadvantages of the zirconia restoration being there. They cannot mechanically

**Table 2:** Currently available pediatric zirconia crowns

Crown	Company	Composition	Features and requirements
NuSmile ZR®	Nusmile Ltd., Houston, Texas, USA	Zirconium oxide 88–96% Yttrium Oxide 4–6% Hafnium oxide 5% etc. <sup>11</sup>	Size- 0–6, Posteriors primary first molars are available in regular or narrow mesiodistal widths. Color/contour- Light and extra light color options, Left/right contoured anteriors, Universal options for lower anteriors only. Manufacturer recommended bur use– Recommendations are provided. Manufacturer reduction requirements– Incisal edge: 1.5–2.0 mm, Occlusal: 1.0–1.5 mm, Circumferential axial reduction: 0.5–1.25 mm or (20–30%), Subgingival: feather margin, Circumferentially 1–2 mm, Round all line and points angles, Final seat: passive. Manufacturer suggested cement- NuSmile biochem, Resin cement, Resin-modified glass ionomer cement. Key features– NuSmile try in crowns: avoids contamination of the crown cemented, NuSmile ZR adjustments burs available, Light and extra light shades. <sup>14</sup>
Cheng Crowns®	Peter Cheng Orthodontic laboratories, Inc., Exton, Pa., USA	Zirconium oxide 88–96% Yttrium Oxide 4–6% Hafnium oxide 5% etc. <sup>11</sup>	Size- 1–6. Color/contour– Single color Left/right contoured. Key features– Smart polish technology crimp-lock retentive margins, Light and extra light shades. <sup>14</sup>
Kinder Krowns®	Mayclin Dental studio, Minneapolis, Minn., USA	Zirconium oxide 88–96% Yttrium Oxide 4–6% Hafniumoxide 5% etc. <sup>11</sup>	Size-1–6, Mid-sized options for cuspids and molars, Short and regular lengths for anterior crowns. Color/contour- Single color, Universal and left/right contoured available for upper anteriors, LP (less Prep) option for anterior and posterior crowns. Manufacturer recommended bur use– Recommendations are provided- Kinder Krowns Prep kit is available. Manufacturer reduction requirements– Incisal edge/occlusal: 1.0 mm, interproximal:1.0 mm, facial/buccal: 1.0 mm, lingual: 1.0 mm, subgingival: feather margin, circumferentially final seat: passive and subgingivally: 1–2 mm. Manufacturer suggested cement- Resin modified glass ionomer cement, Pure glass ionomer cement. Key features– Wear-kind polish-glaze system, Internal retention bands provide increased surface area high gingival acceptance finely feathered margins, Fit check crown available: avoids contamination of the crown cemented, Prep kit and adjustments kit available. <sup>14</sup>
EZ Pedo Crown®	EZ-pedo, Inc., El Dorado Hills, Calif., USA	Zirconium oxide 88–96% Yttrium Oxide 4–6% Hafnium oxide 5% etc. <sup>11</sup>	Size- 1–6. Color/contour– Color enhancers are applied by hand to gingival one-third of the margin, Left/right contoured upper anteriors, Universal options for lower anteriors only. Manufacturer recommended bur use– Promotes the use of EZ Prep burs. Manufacturer reduction requirements Incisal edge/occlusal: 1.5–2.0 mm, Circumference axial reduction: 0.5–1.0 mm (0.85–1.5 mm for posterior), Lingual: 0.75–1.25 mm, circumference subgingival reduction 2mm below gumline, final seat: passive. Manufacturer suggested cement- Pure glass ionomer cement. Key features- Zir-lock ultra-precision milled retention grooves extending all the way to crown margins, Zir plus mirror-polished surface and antireflective coating, EZ Seat contours, EZ Prep bur system. <sup>14</sup>
Signature crown	Not available	Not available	Size– Upper anteriors: A1–A6, Lower anteriors: B1–B6, Upper posteriors and lower posteriors: D1–D6 and E1–E6. Manufacturer reduction requirements– Thinnest crown (crown thickness of 0.5= Less Preparation required). Key features– Less inventory, no space– loss crowns, best shade match, Micromechanical interlocking improve retention, More cost-effective. <sup>15</sup>

retain the crown by crimping it, failure to change its shading, the restricted capacity to manage the crown or adjust its shape, and the requirement for more tooth reduction than a conventional preformed metal crown. Along these, zirconia crowns provide much cosmetic satisfaction in dentistry, and they also offer various benefits.<sup>24</sup>

### Modification of Pediatric Zirconia Crowns

It is hard to modify a zirconia crown since it is ceramic and cannot be managed with scissors like a traditional Stainless-steel crown; it is essential to utilize rapid, fine diamond burs with a vast amount of water on the material that inordinate warmth could cause breakage in the crown's ceramic construction. Occlusal and interproximal adjustments are not suggested, as these will eliminate the crown's glaze and conceivably makes a feeble area of thin ceramic. Because zirconia crowns are constructed of solid zirconia and do not flex, it is important that they fit passively; attempt to sit with force will bring about crack and change with bur result in microfracture. The fitting size crown should fit latently and subgingivally without mutilating the gingival tissue.<sup>22</sup>

### CLINICAL SIGNIFICANCE OF THIS PAPER

There is a wide scope of choices that can be utilized to restore carious primary teeth. Each of which accompanies its benefits. Hence, the material decision relies upon the clinician's inclination, expertise, esthetic, and functional demands of the child.<sup>25</sup> Zirconia crowns are the new and most esthetic pediatric dental crowns accessible available today. These crowns address another methodology and another choice to re-establish the typical appearance of a child's teeth compromised *via* caries or trauma<sup>3</sup> and zirconia crowns are retentive and gingival friendly.<sup>8</sup>

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