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Review Article

Bioflx crowns – An innovative avenue in sculpting children beautiful smile

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Abstract

"Pediatric Dentistry" is not just about teeth and gums anymore. It is all about new avenues, ventures and advancements which struggle to enhance children over all dental health instilling beautiful healthy smile. The beautiful smile not only builds confidence but also provides self -esteem to a pediatric patient. 'Pediatric Dental Care' includes wide array of crowns used to restore both function and esthetics in children afflicted with various dental ailments. These crowns comprise from conventional stainless-steel crowns to a newly introduced zirconia crown. Recently the arena of Pediatric Dentistry has revolutionized with novel type of crowns called as "Bioflx Crowns". There is lack of information and literature about these crowns in Pediatric Dental Literature. Therefore, the aim of this narrative review article is to explore the history, indications, contraindications, composition, comparative evaluation with other crowns, limitations, advantages and challenges, and practicality about the Bioflx crowns to be used in the domain of Pediatric Dental Practice.

Keywords: Bioflx crowns, Children smile, Early childhood caries¸ Esthetic crowns, Pediatric esthetic dentistry

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1. Introduction

Primary teeth in children are essential for speech pronunciation, proper mastication and deglutition and maintenance of space for the eruption of permanent teeth. Therefore, it is highly essential to preserve and take care of these tiny milk teeth until their normal exfoliation. However, more often primary teeth are affected and destroyed by either extensive early childhood caries or dental trauma leading to numerous consequences.[1] For the management of dental caries in primary teeth either direct or indirect restorative treatment procedure can be employed. However, in teeth with multi-surface caries it is difficult to obtain appropriate long-lasting treatment using direct restorations.[2] Therefore, in such cases to restore appropriate function and esthetics full-coverage crowns are more warranted. Even the 'American Academy of Pediatric Dentistry' recommends full-coverage restorations in children with severely decayed, damaged, traumatized and pulpotomized/pulpectomized primary teeth. History recalls conventional stainless-steel crowns as 'gold standard' for restoring primary teeth till date because of their low cost and durability.[3-6] However, concerns over unesthetic metallic appearance of these crowns led to a 'quest' for introduction of newer esthetic crowns like polycarbonate crowns, composite strip crowns, zirconia crowns and Bioflx crowns.[4-8]

Bioflex crowns represent a modern and an innovative esthetic restorative option for primary anterior teeth, providing superior esthetics, durability, self-adaptability and biocompatibility compared to conventional stainless-steel crowns.[9] These are newly introduced tooth-colored crowns for pediatric patients in the domain of Pediatric dental practice. Extensive review of pediatric dental literature revealed paucity of evidence, articles and publications in the google and pubmed search. Therefore, aim of the current research paper is to provide a detailed insight into Bioflx crowns to be considered as a possible esthetic treatment modality for all pediatric patients suffering from dental caries.

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2. Review of Literature

The present review of literature pertaining to Bioflx crowns provides a detailed analysis about indications, contraindications, composition and design of the crown, advantages, limitations, clinical procedure, patient acceptance and practicality in pediatric dental care.

2.1. Indications of bioflx crowns

Indications for application of Bioflx crowns have similar indications represented for other conventional crowns used in children.[9] The **Table 1** provides detailed picture about indications for the use of Bioflx crowns in pediatric patients.

Table 1: Indications for Bioflx crowns

S.No.	Indications
1	Hypoplastic or malformed primary teeth
2	Extensive multi-surface caries in primary anterior or posterior teeth
3	Children or parents with high esthetic demand
4	Traumatized primary teeth
5	Primary teeth with post-pulpotomy/ pulpectomy procedure

2.2. Contraindications of bioflx crowns

Bioflx crowns are contraindicated in patients with severe bruxism or parafunctional habits and in patients with deep subgingival caries requiring extensive crown lengthening. [9]

2.3. Composition of bioflx crowns

Bioflx crowns are manufactured from high-impact hybrid radiopaque polymer resin hence they have enhanced strength, durability and flexibility. The polymer resin is nothing but a bisphenol A-glycidyl methacrylate-free monochromatic tooth-colored material making the crown completely biocompatible material. Because of this product, Bioflx crowns mask the discoloration of arrested caries and also the discoloration caused by silver diamine fluoride.[9]

The **Table 2** illustrates the composition of Bioflx crowns. In comparison to zirconia crowns, Bioflex crowns have a thin metal layer beneath the composite veneer. Hence, they are more flexible and easier to adapt to the tooth surface. Whereas zirconia crowns are completely made of ceramic hence, not flexible.[9]

Table 2: Composition of bioflx crowns

Content	Purpose
Nickel-Chromium (Ni-Cr) alloy	Provides strength and flexibility
Composite veneer	Provides natural tooth colour (enhances esthetics)

2.4. Design of bioflx crowns

Bioflx crowns are manufactured by Kids-e-Dental, LLP, Mumbai, India and represent one of the first, superior pediatric esthetic crowns that are flexible, durable, self-adaptable, and esthetic in appearance. Bioflx crowns are available in different sizes to fit both primary anterior teeth (including incisors and canines) and posterior molars.[7-10]

Based on manufacturer's instructions, Bioflx crowns can be adapted easily as they provide a snug fit. They can be easily altered when they found in high occlusion by adding a dimple on that area. They have a radiopacity of 1 mm that allows differential evaluation of the crown margins and pulp capping medicaments when viewed on radioviseograph (RVG). Overall comparison to stainless steel crowns, Bioflx crowns require only minimal adjustments.[8-15]

2.5. Clinical procedure for placement and adaptation of bioflx crown

The clinical steps followed during placement and adaptation of Bioflx crowns involves similar steps followed for other crowns with some modifications.[9] The detailed steps are illustrated in **Table 3**.

Table 3: Clinical steps employed for placement of bioflx crowns

Clinical Steps	Procedure
Tooth preparation	• Administration of local anesthesia if needed. • Caries removal and pulp therapy is carried out if required. • Minimal circumferential reduction of 0.5-1 mm is done. • Line angles are rounded off for better adaptation.
Crown Selection and Adaptation	• Selection of appropriately sized crown based on mesiodistal width of the tooth crown. • Trimming of margins if needed for proper fit.
Cementation	• Cleaning and drying the tooth. • Use resin-modified glass ionomer or self-adhesive resin cement for cementation. • Evaluation of proper seating and removal of excess cement.
Finishing and Polishing	• Adjustment of occlusion if required. • Polishing of margins for smoothness.

2.6. Advantages of bioflx crowns

Bioflx crowns have various advantages compared to other available crowns. The **Table 4** represents advantages of Bioflx crowns.

Table 4: Advantages of bioflx crowns[7-15]

S.No.	Advantages
1	Superior esthetics - Bioflex crowns provide a natural tooth-like appearance, making them more preferable for anterior restorations compared to unesthetic stainless steel crowns.
2	Biocompatible – Compared to polycarbonate crowns, Bioflx crowns are more biocompatible and do not cause allergic reactions in children.
3	Minimal tooth preparation - Requires minimal tooth reduction compared to zirconia crowns, thereby preserving more natural tooth structure.
4	Cost effectiveness - More cost effective compared to zirconia crowns with respect to comparable superior esthetics.
5	Durability and Strength - The Nickel Chromium sublayer provides fracture resistance, whereas the composite layer provides wear resistance.
6	With regard to sterilization, autoclave can be recommended as similar to stainless steel crowns.
7	Crimping is not required. Only slight contouring is recommended and it is done with Howe pliers.
9	Trimming can be done with scissors followed by smoothing the trimmed margins using football diamond bur.
10	Crown may self-adapt in areas found with slightly high occlusion
11	Sandblasted intaglio surface of bioflx crowns provide enhanced retention with self-setting resin modified glass ionomer cement (RMGIC) or conventional glass ionomer cement (GIC).
12	Wear resistance of Bioflx crowns is similar to or better than traditional stainless-steel crowns.

2.7. Limitations and challenges of bioflx crowns

Bioflx crowns exhibit very few limitations and challenges (**Table 5**). Manufacturers claim these crowns have superior longevity and survival rates of 85-90% for a period of 3-5 years. Failures are mostly due to debonding or veneer chipping rather than structural damage. Challenges and future perspectives are targeted on improved composite materials for better wear resistance and adoption of CAD/CAM customization for better fit of the crown.[14-16]

Table 5: Limitations and challenges bioflx crowns

S.No.	Limitations and Challenges
1	Technique Sensitivity- Bioflx crowns require correct crown adaptation and cementation to overcome chances of debonding.
2	Lack of clinical Studies with long-follow up – Clinical studies with long term follow up in comparison with other crowns are scanty.
3	Potential for Veneer Chipping - There are chances of chipping of composite layer under excessive occlusal load even though it is durable.

3. Discussion

It is well known fact that primary teeth with early childhood caries is the most observable dental finding in every day pediatric practice across the globe. Various treatment modalities have been researched to manage such afflicted primary teeth finally to provide function and esthetic and also to gain self-esteem among children and their parents. Restorative treatment procedures for primary teeth involve both direct and indirect restorations.[1-3] Due to various draw backs of direct restorative options, full coverage restorations or crowns revolutionized the field of peditric restorative dentistry. Full coverage crowns have started with conventional stainless-steel crowns and established as a gold standard because of its superior durability and low-cost factor. However, because of their unesthetic metallic appearance, and due to increased demand for esthetic options by parents, broader range of esthetic crown options like polycarbonate crowns, resin-based composite strip crowns and zirconia crowns have started engulfing the pediatric dental domain.[4-8] Unfortunately, it is evident that each type of crown including stainless steel crowns, zirconia crowns, and strip crowns comes with its own set of unique features, advantages, and disadvantages. Moreover, the selection of the most appropriate crown option is influenced by different factors, such as esthetic demands, durability, cost considerations, and specific clinical indications (**Table 6**). This crucial decision-making process, is highly essential for selection of the most appropriate crown type for children ensuring the best possible outcome tailored to the individual needs and circumstances of each patient.

Full coverage restorations involve crowns made either with metallic or other biomaterials. Hence the crown is considered the most effective restorative option for the management of dental caries. It reproduces the natural original morphology, anatomy and contour of the damaged coronal portion of the tooth in addition to maintaining its function.[6-8]

Table 6: Comparative evaluation of different esthetic crowns with bioflx crown

Comparable Parameter	Polycarbonate crown	Strip crown	Zirconia crown	Bioflx crown
Esthetics	Moderate	Good	Excellent	Excellent
Durability	Low to medium	Low	Very high	High
Composition	Acrylic based	Composite resin	Monolithic zirconia	Nickel chromium, composite
Tooth preparation requirement	Minimal	Minimal	Moderate	Minimal
Cost effectiveness	Low	Low	High	Moderate

Introduction of Bioflx crowns to the arena of pediatric dentistry represent an innovative development in challenging esthetic rehabilitation of primary teeth affected with dental caries or trauma.[9] These newer crowns are more popularized for their outstanding flexibility and adaptability in comparison with other available crowns. Bioflx crowns exhibit combined properties of both stainless steel and zirconia crowns. In composition, these crowns consist of a biocompatible hybrid resin polymer, which is the main factor essential for their superior properties such as ductility, color stability, and durability. Moreover, Bioflx crowns provide a "flex fit" adaptation over the natural anatomic cervical contour of primary teeth, similar to stainless steel crowns.[9-15] Additionally, these newer crowns also exhibit a more pleasing esthetic appearance and conservative tooth preparation, comparable to zirconia crowns (**Table 6**).

Although zirconia crowns offer superior esthetic biocompatible full coverage option for primary teeth, they have a number of drawbacks and pose several challenges, including the need for higher tooth reduction potentially prolonging the duration of dental procedures, the inability to be crimped, the expansion it causes, the wearing out of the tooth next to it, and the inability to be utilized in patients who have strong occlusal forces.[9-13] Manufacturers also advice for passive seating of these crowns mainly depending on dental cement for retention. The dependence on cement, along with the challenges in modifying crown margins, presents clinical challenges for proper adaptation.[18-21] Furthermore, their high cost makes them a more costly esthetic option compared to other crowns. Whereas Bioflx crowns require minimal tooth reduction and are handled easily.[9] Bioflx crowns along with combined properties of the flexibility and adaptability of both stainless steel and zirconia crowns have shown convincing promise in terms of esthetics and conservative tooth preparation. However, currently, there are scanty available comparative studies assessing the properties of Bioflx crowns, their impact on clinical outcomes, and parental satisfaction (**Table 7**). Clinical trials on Bioflx crowns for the evaluation of their durability, flexibility, retention and good permanent cosmetic look are still ongoing. This gap underscores the need for focused research to evaluate how these crowns can be compared with traditional crowns like stainless steel and zirconia crowns, especially considering their potential advantages in esthetics and tooth conservation.[12-15] Therefore, more extensive research is highly warranted to fully establish their efficacy and long-term outcomes in pediatric dental care.

Only few case reports and case series showed satisfying results in terms of ease of placement, esthetic satisfaction, and clinical performance. Goswami et al in 2024[14] in their case series, successfully managed three children with carious and pulp therapy treated primary molars using Bioflx crowns. All cases were followed up for six weeks period and authors found favourable outcomes in terms of durability, good retention, esthetic appearance and patient as well as parent's satisfaction. This case report had showed high acceptance rates from both patient and parent due to their natural appearance, comfortable fit and reduced need for replacements compared to other restorations or crowns.

A recent 2025 research article[18] evaluated and compared the wear of the Bioflx crowns and opposing enamel. Authors also evaluated the color stability of Bioflx crowns using thermodynamic aging in comparison to zirconia crowns. In this research thermodynamic cycling was conducted to simulate oral conditions for six months. Wear resistance was quantitatively assessed utilizing a universal serial bus (USB) digital microscope with an integrated camera. Color stability was measured using a spectrophotometer before and after thermal aging and following immersion in various solutions like water, milk chocolate, orange juice and cola drink. From this investigation, a statistically significant difference was observed between zirconia and Bioflx crowns regarding volume loss and average enamel. With regard to color change, the results demonstrated non-significant differences between zirconia and Bioflx crowns before and after thermocycling aging and following immersion in different solutions. Researchers concluded that zirconia crowns cause more wear on opposing natural teeth than Bioflx crowns.[18] Whereas Bioflx crowns showed a higher average wear rate compared to zirconia crowns. However, there was no significant difference observed between the two crown's materials in terms of color change after aging and immersion in various solutions.

Table 7: Case reports and clinical studies on bioflx crowns

Author & Year of Publication	Type of Publication	Aim of the Study	Conclusion
Rahate et al,[15] 2023	Original Research (In-vivo study)	To assess the clinical performance and child and parental satisfaction of Bioflx crowns compared to zirconia and stainless-steel crowns.	Bioflx crowns have better clinical as well as parental satisfaction among zirconia and stainless-steel crowns.
Madhusudhan et al,[19] 2023	Case report (one case)	Bioflx crown was given for managing a multi-surface caries lesion in an 8-year-old girl.	Satisfactory outcome
Goswami et al, 2024	Case series (3 cases)	Bioflx crown was given for pulpectomized primary molars.	Dealing with the esthetic needs of children and managing primary molars using Bioflx crowns would be practical and successful.
Lath et al,[16] 2024	Original Research (In-vitro study)	To compare the shear stresses generated by BioFlx crowns, Zirconia Crowns and the gold standard Stainless Steel Crowns when restoring extensively decayed deciduous teeth using finite element analysis (FEA).	BioFlx crowns, in combination with the underlying core material, can withstand maximum loads, suggesting that a mutilated primary posterior tooth restored with glass ionomer cement and a BioFlx crown may be a viable option for frequent clinical use.
Patil et al,[17] 2024	Original Research (In-vivo study)	To assess and compare the clinical outcomes of Bioflx crowns with stainless steel crowns in primary molars.	The 12-month results indicated that Bioflx crown performed similarly to the established Stainless-steel crown for the restoration of primary molars providing better esthetics.
Abdou, N.ES.F.,[18] 2025	Original Research (In-vitro study)	To evaluate and compare the wear of the crowns and opposing enamel. Additionally, to assess the color stability of Bioflx pediatric crowns following thermodynamic aging compared to zirconia crowns.	Zirconia crowns caused more wear on opposing natural teeth than Bioflx crowns. Bioflx crowns show a higher average wear rate than zirconia. There are no significant differences between the two crown's materials in terms of color change after aging and immersion in various solutions.
AlMawash et al,[21] 2025	Original Research (In-vitro study)	To evaluate and compare the retentive strength of Bioflx crowns and Stainless-steel crowns with different types of luting cement (glass ionomer cement [GIC], resin-modified glass ionomer cement [RMGIC], self-adhesive resin cement [SARC], and polycarboxylate cement [PXC]).	Stainless-steel crowns emerge as the preferred choice for full-coverage restorations that require optimal retention and durability. Nevertheless, Bioflx crowns with SARC provide a viable alternative when esthetic considerations are prioritized.

Another study[19] evaluated the clinical performance and child and parental satisfaction of Bioflx crowns compared to zirconia and stainless-steel crowns. In this clinical trial, 72 primary teeth requiring crowns were selected and randomly divided into three groups as group I, II and III. In group I, preformed stainless steel crown was given, group II preformed Bioflx crown and in group III preformed zirconia crown were given.[17] Clinical parameters like recurrent caries, plaque accumulation, restoration failure, gingival status, opposing tooth wear, and clinicians and parental satisfaction were evaluated at three, six- and 12-months period. From this research, it was found that Bioflx crown showed better clinical and parental satisfaction among zirconia and stainless-steel crowns.[17]

In present century with advanced technology and modern world, parents and children are more concerned with the esthetics of their both primary and permanent teeth.[1-3] According to Jean Piaget, a great philosopher and psychologist, a child's perception of their appearance does not develop until they are eight years old. But recent research in the domain of child psychology has changed this idea, demonstrating that, with increased social media exposure, even children as young as 3–5 years old have a concern about their smile.[5,8,22] A 'beautiful smile' always depends on the

color, shape, and texture of the overall teeth's surface. As a result, not only parents, even children with destroyed, unesthetic teeth appearance mandatorily seek superior esthetic look in their smile. Therefore, esthetic needs of children and the demands of parents have brought advancement in pediatric dentistry toward a new era of esthetic crowns.[6-9] In this era of esthetic crowns, the recently launched and an innovative Bioflx crowns represent the definite solution for sculpting children beautiful smile and seems to be an effective esthetic treatment option in the field of modern pediatric restorative and esthetic dentistry.

4. Conclusion

Bioflx crowns represents more of esthetic, durable and reliable full-coverage restorative option for the treatment of primary teeth. In spite of few drawbacks, their advantages prove them a valuable choice over traditional stainless-steel crowns and other esthetic crowns in many clinical scenarios. However, further research with long-term follow up and with larger sample size in comparison with other crowns is highly recommended to ultimately robust their performance and adoption in pediatric esthetic dentistry.

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None.

6. Conflict of Interest

None.

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