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SPECIAL FOCUS PAPER

3D Printed Crowns in Pediatric Dentistry – A New Era

Yash Bafna[1] (✉), **Asokan Vasudevan**[2], **Madhulika Bafna**[1], **Shoba Fernandes**[3], **Geetha Subramaniam**[2]

[1]Narsinhbhai Patel Dental College and Hospital, Sankalchand Patel University, Visnagar, Gujarat, India

[2]INTI International University, Nilai, Malaysia

[3]Dental Practitioner, Ahemdabad, Gujarat, India

ybafna.fds@spu.ac.in

ABSTRACT

3D-printed crowns are a unique and effective treatment modality for controlling dental Caries by restoring the form, function, and integrity of damaged coronal tooth structure. Increasing Esthetic demands from parents and children have led to the development of tooth-colored crown Options in pediatric dentistry. The preformed 3D-printed High Strength Composite Resin (HSCR) Crown offers a promising, esthetic, and cost-effective alternative. These 3D printed crowns are unique, as they can be trimmed, polished, repaired, and secured to prevent aspiration or ingestion during the procedure. This crown has compressive strength similar to enamel, around 250–300 MPa. Crowns will show attrition similar to natural teeth, which makes this crown unique, as during the early age, a lot of changes in occlusion are going on. This case series report shows satisfactory retention, functional performance, and aesthetic outcomes of HSCR crowns used for primary and over a six-month follow-up, demonstrating their clinical feasibility and acceptability.

KEYWORDS

case report, crowns, dental caries, esthetic, pediatric dentistry

1 INTRODUCTION

Additive manufacturing has significantly changed dentistry by offering a newer alternative to conventional milling of crowns. The additive manufacturing is done in a layer-by-layer polymerization of resins. This method of manufacturing a crown minimizes waste and enables the fabrication to follow the individual anatomy of the tooth. The digital scan of the tooth and design of the crown using software, followed by printing of the crown, will be the common future flow of every clinic [1].

Ceramic is a gold standard material for crown restorations due to its excellent biocompatibility, high flexural strength, fracture toughness, and favorable esthetic properties. Ceramic-reinforced resin has been in use for additive manufacturing. Literature supporting 3d printed crowns showing better marginal fit and adaptation than zirconia crowns [2]. The preformed High Strength Composite Resin (HSCR) contains Nano ceramic fillers greater than 50%. These reinforced resins have better mechanical strength, surface hardness, and wear resistance, thereby broadening the

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potential application of 3D printed crowns in both permanent and pediatric restorative dentistry, particularly in cases requiring conservative preparation and efficient clinical workflows [3].

Preformed HSCR (Pedocrown Dental Pvt Ltd, Ahmedabad, India) crowns represent a recent addition to the range of esthetic pediatric crowns. Designed specifically to meet children's esthetic needs, this case series demonstrates the clinical use of prefabricated HSCR crowns for restoring carious primary and permanent teeth in pediatric patients.

2 CASE DESCRIPTION

A 4.5-year-old male patient presented with multiple decayed primary teeth affecting daily routine functions. The child was systemically healthy, and clinical and radiographic examination indicated a case of Severe Early Childhood Caries (S-ECC). Multiple Pulpectomies followed by crown and space management were required.

Fig. 1. Postoperative clinical images

Source: Compiled by authors.

Prefabricated HSCR crowns were planned based on the child's age, aesthetic needs, and degree of tooth structural loss. Following the manufacturer's instructions, the teeth were prepped under local anesthetic, and HSCR crowns were chosen, tested, adjusted, and cemented.

With good practical and aesthetic results, the treatment was successfully finished. The follow-up revealed better aesthetics, a healthy gingival response, and satisfactory crown adaptation. Figures 1 and 2 display post-operative clinical and radiographic images, respectively.

2.1 Tooth preparation

Before tooth preparation, a local anesthetic should be given, and the operating field should be well isolated. To prevent excessive tooth reduction, manufacturer-recommended reduction guidelines should be closely adhered to because premade HSCR crowns are relatively thick and robust. Proper preparation shortens chair-side time and enhances crown fit and aesthetics. The tooth needs to be ready for the crown to passively seat on it without applying any pressure.

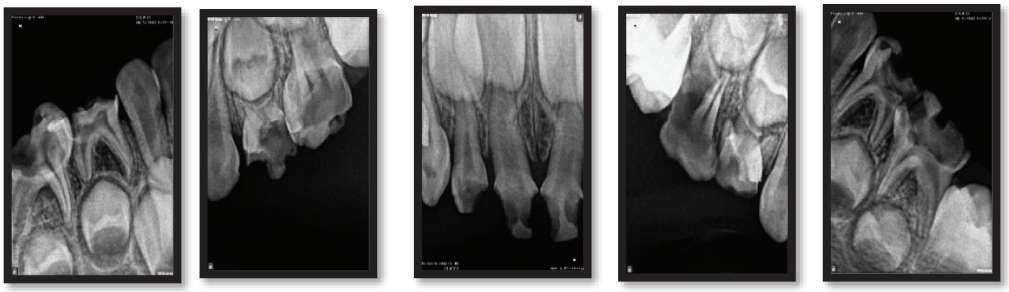

Fig. 2. Post operative radiography images

Source: Compiled by authors.

2.2 Incisal reduction

A tapered diamond bur should be used for incisal reduction of about 2 mm. The final occlusal plane is determined by adequate occlusal reduction, which is necessary for appropriate crown seating. With a feather-edge margin positioned 1–2 mm subgingivally, the preparations should be free of undercuts and somewhat convergent toward the incisal surface.

2.3 Peripheral reduction

It is advised to reduce the circumference of teeth by roughly 1 mm. To allow for passive crown seating, all line and point angles should be rounded, and the preparation should adhere to the natural curves of the tooth. Sharp edges should be removed, and the lingual surface should be reduced by 1–1.25 mm and extended 1–1.5 mm subgingivally.

2.4 Subgingival extension

Complete crown coverage, healthy gingival adaptation, and enhanced retention are all guaranteed by subgingival extension. To reduce gingival damage, a thin, tapered diamond bur should be employed. HSCR crowns on primary molars follow similar guidelines.

Fig. 3a. Postoperative clinical images

Source: Compiled by authors.

2.5 Try-in and cementation

HSCR crowns are rigid; it's important to try them in carefully. If necessary, minor cervical adjustments can be accomplished under water spray. To guarantee the best possible crown retention, the tooth should be cleansed, and gingival bleeding should be managed with pressure or hemostatic agents before cementation. Resin or GIC-based cement can be used.

for cementation. Figures 3a, 3b, and 4 depict post-operative clinical and radiographic images, respectively.

Fig. 3b. Postoperative clinical images

Source: Compiled by authors.

Fig. 4. Postoperative radiography images

Source: Compiled by authors.

3 DISCUSSION

Esthetic dentistry has emerged as a top concern in modern dental practice.

RVG 74,75	RVG 16,54	RVG 64	RVG 84,85	RVG 51,52	RVG 61,62

According to a 2009 survey, the aesthetic quality of restorative materials is highly valued by parents of pediatric patients [4].

Stainless Steel Crowns (SSC), zirconia crowns, and Bioflx crowns are currently the three primary crown types most frequently utilized in pediatric dentistry. Despite their durability, SCC have obvious aesthetic drawbacks. Although very aesthetically pleasing, zirconia crowns are somewhat costly, necessitate significant tooth reduction, and do not permit chairside alteration. There is no data on the long-term clinical performance of Bioflx crowns, despite the fact that they require more conservative tooth preparation and have encouraging aesthetic results [5].

Despite their aesthetic appeal, composite strip crowns are technique-sensitive and prone to moisture contamination; problems such as gingival irritation, shade mismatch, crown loss, and marginal flaws have been documented. As a result, prefabricated zirconia crowns have become more and more popular because of their excellent aesthetics, biocompatibility, decreased plaque buildup, and high parental satisfaction. However, their placement is technique-sensitive and necessitates strong patient participation, careful case selection, and sufficient tooth structure [6].

3D printing and additive manufacturing have been used to create HSCR crowns. This resemblance leads to more acceptable failure patterns and promotes optimum stress distribution. Furthermore, resin allows for easy intraoral modification and repair of this crown. When compared to alternative restorative solutions, resin composite materials have been shown in several studies to have greater fracture resistance [7]. HSCR crowns produced by 3D printing and milling, affirming that both fabrication methods yield clinically acceptable levels of marginal adaptation, internal fit, and precision [8]. The marginal fit of 3D-printed crowns is comparable to milled counterparts [9].

While milled ceramics typically perform better than printed resins in terms of flexural resistance, a comparative study comparing the flexural strength, marginal gap, and internal fit of milled and 3D printed materials revealed that the internal fit and marginal integrity of printed materials can be clinically sufficient for specific applications [7].

Similar fracture resistance and marginal fit findings were obtained in a 2025 in vitro comparison study between prefabricated zirconia crowns and 3D-printed resin crowns in primary molars, indicating that printed resin crowns may be a viable option in pediatric or temporary restorative situations [10–13].

4 CONCLUSION

With evidence of a good fit, adaptability, and gradual advances in mechanical behavior, 3D printing is becoming a competitive digital alternative for crown production. Additive manufacturing is quickly moving toward equivalent clinical performance, especially in resin-based and pediatric applications, even though milled zirconia crowns continue to perform better in some mechanical parameters. Long-term clinical trials and ongoing research are necessary to completely confirm the widespread use of 3D printed definitive crowns.

By repairing broken teeth and promoting a child's general oral health and mental health, dental crowns are essential in pediatric dentistry.

The opposing dentition did not experience anomalous or accelerated wear as a result of HSCR crowns.

In clinical examination, HSCR crowns showed outstanding retention.

Because of the positive aesthetic results of HSCR crowns, parents expressed a high level of acceptance and pleasure.

The gingival reaction to HSCR crowns was healthy, suggesting that they were biocompatible with the soft tissues around them.

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7 AUTHORS

Yash Bafna is with the Department of Pediatric and Preventive Dentistry, Narsinhbhai Patel Dental College and Hospital, Visnagar, Gujarat, India (E-mail: ybafna.fds@spu.ac.in).

Asokan Vasudevan is with the INTI International University, Nilai, Malaysia (E-mail: asokan.vasudevan@newinti.edu).

Madhulika Bafna is with the Department of Pediatric and Preventive Dentistry, Narsinhbhai Patel Dental College and Hospital, Visnagar, Gujarat, India (E-mail: dr.madhulikabafna9@gmail.com).

Shoba Fernandes is with the Dental Practitioner in Ahmedabad, Gujarat, India (E-mail: sfernandes.fds@spu.ac.in).

Geetha Subramaniam is with the Faculty of Health and Life Sciences, INTI International University, Nilai, Malaysia (E-mail: geetha.subramaniam@newinti.edu.my).