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Original Research

Evaluation of Edelweiss and BioFlex crown systems with post and core restorations in pediatric anterior teeth: A novel study

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ABSTRACT

Background: Aesthetics play a vital role in modern dental practice. Preserving primary teeth is essential for a child's overall development and well-being. Post and core treatment is a common approach for restoring damaged primary anterior teeth caused by trauma or decay. However, choosing the most suitable material for this procedure remains a challenge.

Objective: To evaluate and compare the clinical outcomes of Edelweiss and conventional intracanal posts (omega loops) in restoring carious primary anterior teeth.

Methods: Twelve subjects meeting the inclusion criteria were selected and divided into two groups of six. Group I received Edelweiss post and core with Edelweiss crowns, while Group II was treated with conventional post and crown (omega loop) using Bioflex crowns. Clinical parameters, including Oral Hygiene Index (Green & Vermillion), Bleeding Index, Gingival Index, and the United States Public Health Service (USPHS) criteria, were assessed. The USPHS criteria examined anatomical form, marginal adaptation, surface texture, marginal discoloration, color match, interproximal contact, and recurrence of caries. Evaluations were conducted at intervals of 3, 6, and 12 months.

Results: Statistically significant differences ($P < 0.005$) were observed between the groups in oral hygiene, bleeding, gingival indices, and USPHS criteria.

Conclusion: Preserving severely decayed primary teeth as natural space maintainers provide both functional and aesthetic advantages, highlighting the value of effective post and core systems in pediatric dentistry.

***Keywords:** Early childhood caries, Edelweiss, Omega loop, Post and core.*

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INTRODUCTION

Aesthetics were a significant concern in modern dentistry, with both children and their parents seeking visually appealing anterior teeth. An attractive smile was often regarded as a social asset, creating positive first impressions and influencing perceptions of personal characteristics. Even children were conscious of their dental appearance and expressed concerns about the look of their teeth. Damage to primary teeth in children commonly resulted from trauma or early childhood caries (ECC). According to the American Academy of Pediatric Dentistry (AAPD), ECC involved one or more decayed, missing (due to decay), or filled tooth surfaces in a child under six years old. Severe ECC was characterized by smooth-surface caries in children under three, or by significant decay, missing, or filled maxillary anterior teeth, as well as specific age-based criteria for decayed, missing, and filled teeth scores in children aged three to five.[1]

Maxillary incisors were particularly vulnerable to ECC, with severe cases often leading to complete crown destruction. Trauma from falls, accidents, or sports activities was another common cause of damage to primary teeth, resulting in functional, psychological, and aesthetic challenges. Such injuries often had long-lasting effects on teeth and supporting structures. Severely damaged or decayed primary teeth typically required comprehensive restoration to achieve functional and aesthetic balance. Historically, extraction was the preferred treatment for severely damaged primary anterior teeth, but it posed risks such as reduced vertical occlusion, space loss for permanent teeth, the development of oral habits, and aesthetic concerns.[2]

Restoring primary teeth posed unique challenges due to their small size, large pulp chambers, and the young age of the patients. Composite resins were widely used for anterior restorations, as they helped rebuild tooth structure while preserving its integrity.[3] However, differences between primary and permanent teeth, such as thinner dentin in primary teeth, often limited the bonding potential of composites. In cases of severe decay requiring pulpectomy, intracanal retention was critical for the longevity of composite crowns.

Advancements in restorative materials, such as veneered stainless steel crowns, art glass crowns, polycarbonate crowns, and strip crowns, had expanded treatment options, enabling preservation over extraction.[4] Despite these advancements, materials used for cases with significant structural loss often failed to withstand occlusal forces, prompting the adoption of post and core systems for additional support.

Post and core restorations were frequently employed for severely decayed or traumatized teeth with extensive crown loss. The post was placed in the root canal to provide structural reinforcement, followed by a core build-up material. Preserving primary teeth was essential for children's overall development and well-being, and post and core techniques became widely accepted treatment methods.[5]

However, selecting an ideal post and core material for primary teeth remained challenging. The material needed to be resorbable, durable, and free of adverse effects such as root fractures or infections. Recently, the root stumps of primary teeth were explored as potential post and core materials.

This study aimed to evaluate the clinical efficacy of Edelweiss posts compared to traditional intracanal posts in restoring the coronal structure of carious primary anterior teeth.

MATERIALS AND METHOD:

The research was conducted in the Department of Paediatric and Preventive Dentistry at Krishnadevaraya College of Dental Sciences, Bangalore, following approval from the institution's ethics committee. The study utilized Bioflex crowns (Kids-e-Dental), Edelweiss post and core, and Edelweiss crowns (Edelweiss Dentistry). Participants were randomly selected from the outpatient department and assigned to two groups based on the selection criteria.

Inclusion criteria:

- Extensive loss of coronal tooth structure (≥50%),
- Sufficient canal wall thickness (at least 2 millimeters)
- Unseal able root canal, and informed consent.
- Supragingival at least 1 mm of the tooth structure should be left

Exclusion Criteria:

- Untreated caries
- Root inflammation
- Root damage
- Insufficient canal length and thickness
- Canal curvature from further analysis
- Some parents refused to allow their children to participate in the experiment

Sample Size Calculation:

The sample size for the present observational study was calculated using GPower software (version 3.1.9.7; Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany). The estimation was conducted a priori with a two-tailed test, assuming a normal parent distribution. An alpha error probability of 5% ($\alpha = 0.05$), an effect size of 1.90 (based on the findings from the study by Hua Xu et al., 2024, which reported a difference in the mean GI scores between two groups at a 3-month follow-up), and a power of 80% ($1-\beta = 0.80$) were considered. The analysis revealed a minimum required sample size of 12 participants, with 6 samples per group. The noncentrality parameter (δ) was 3.2158806, critical t was 2.2455288, degrees of freedom (df) were 9.4591559, and the actual power was 0.8205434. To account for an anticipated 10% attrition rate during the follow-up period, the sample size was inflated to 14 participants, with 7 samples allocated to each study group.

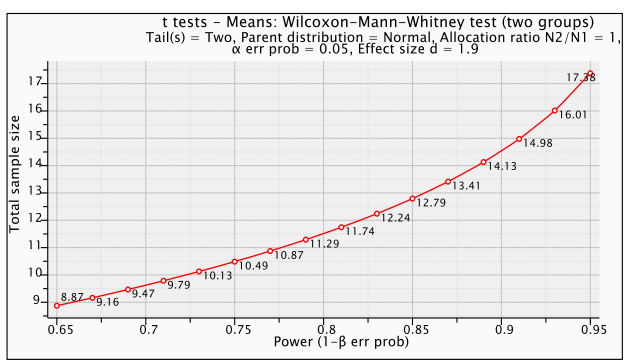


Figure 1: Sample size estimation for an observational study using GPower software

Statistical Analysis: The statistical analyses were conducted using the Statistical Package for Social Sciences (SPSS) for Windows, Version 22.0 (Released 2013, Armonk, NY: IBM Corp.). Descriptive analysis was performed for all explanatory and outcome parameters, with quantitative variables summarized using mean and standard deviation, and categorical variables described using frequencies and proportions. To compare the mean values of clinical parameters between the two groups before and after treatment, the Independent Student's t-test or Mann-Whitney U test was used, depending on the data distribution. Repeated measures ANOVA followed by Bonferroni's post hoc test, or the Friedman test followed by Wilcoxon Signed Rank post hoc test, was applied to assess mean values of clinical parameters across different time intervals within each group. The level of significance (P-value) was set at $P < 0.05$, and additional statistical tests were applied as required during the analysis.

METHODOLOGY

Twelve children were selected and grouped equally into two groups [each group consisting of six subjects] who satisfied the inclusion criteria for post and core crown.

- Group I- Edelweiss post & Edelweiss crown
- Group II- conventional post (omega loops) & Bioflex crown

After obtaining institutional ethical committee clearance, the parents/ guardians of the children were thoroughly explained the study procedure which had already taken for the previous study.

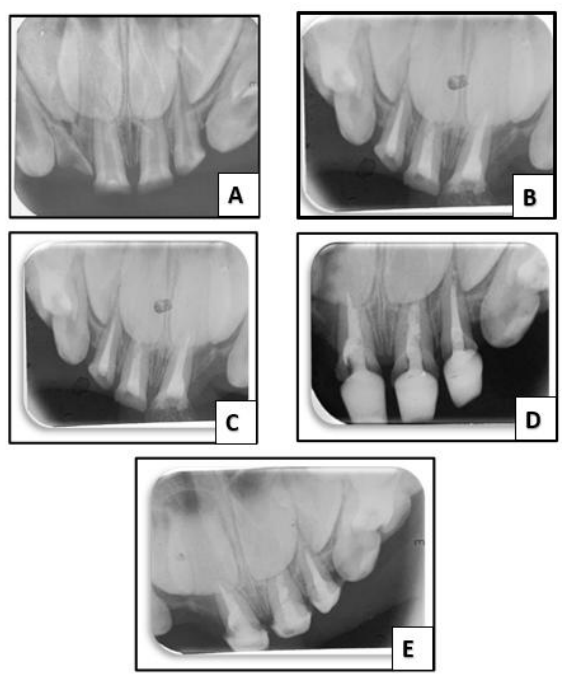


Figure 2: A. Pre-operative view, B & C. Obturation process, D. Edelweiss post and core placement, E. After Edelweiss crown placement

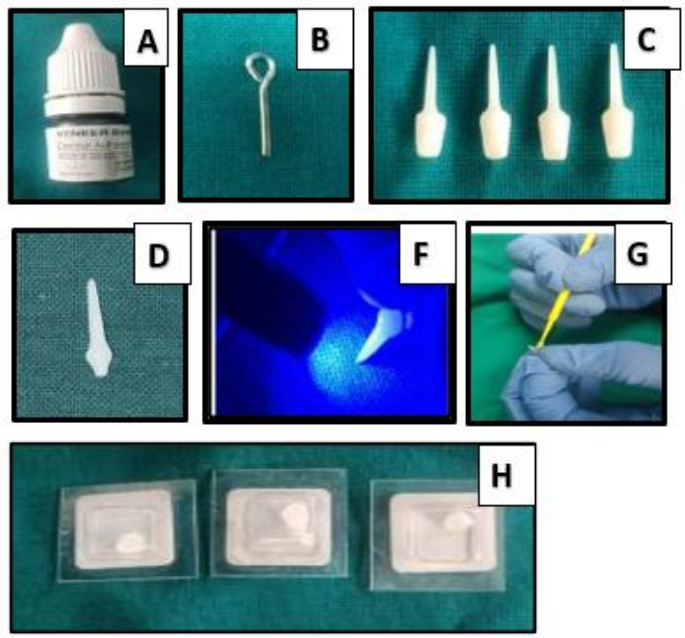


Figure 3: A. Veneer bond application, B. Omega loop placement, C & D. Edelweiss post and core placement, F. Curring of the post, G. Application of veneer bond, H. Edelweiss crown placement

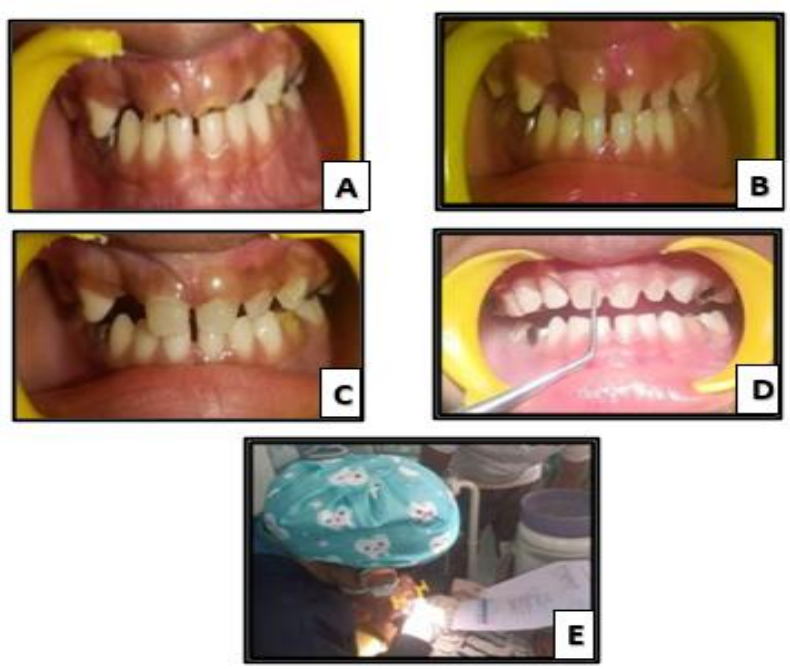


Figure 4 : A. Preoperative view, B. After post and core buildup, C. Edelweiss crown placement, D. Checking the OHI, Gingival Index, Bleeding Index, and USDA scores

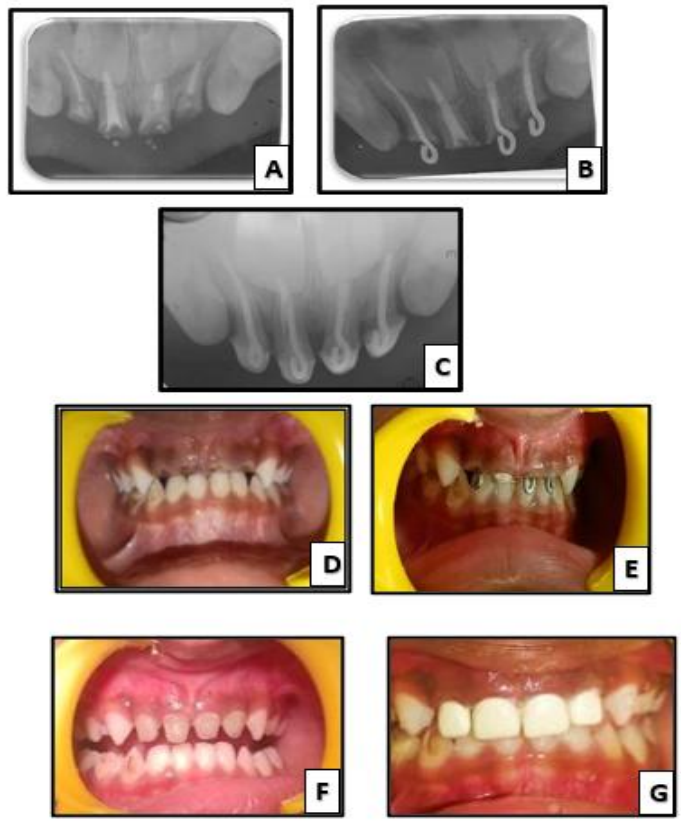


Figure 5: A, D. Preoperative view, B, E. Omega loop placement, C, F. After composite buildup, G. After cementation of Bioflix crown

The study included 12 children (6 in each group) with carious primary incisors, who were divided into two treatment groups: Group 1 received Edelweiss post and core restorations with Edelweiss crowns, while Group 2 underwent conventional post and core restorations with Bioflix crowns. The restoration process involved several stages. During the preoperative assessment, visual and instrumental examinations, including dental X-rays, were performed to evaluate the extent of coronal damage. Endodontic treatment involved removing carious tissues, preparing access cavities, performing vital pulpectomies with saline irrigation, and cleaning the root canals using KEDO SG blue rotary files, followed by obturation with Metapex. Post-space preparation, conducted a week later, involved removing temporary canal fillings and shaping the canals using the step-back method with K-files. Radiographs confirmed post-space depth, and countersink holes with anti-rotation slots were created using round/oval burs.

For post and core placement, Group 1 used Edelweiss posts bonded with Edelweiss VENEER Bond, light-cured, and coated. The canals were etched with 35% phosphoric acid, primed, and cured before Edelweiss crowns were cemented with compomer. In Group 2, 2-3 mm of Metapex was removed with H-files, and a 0.7 mm stainless steel orthodontic wire, bent into a half-omega shape, was inserted into the canal with composite material, light-cured, and covered with a Bioflix crown. Final adjustments to occlusion and polishing completed the process. Patients were followed up at 3, 6, and 12 months to assess oral hygiene (Green-Vermillion Index), gingival health (Gingival and Bleeding Indices), and restoration quality using USPHS criteria. The focus was on evaluating the condition of supporting tissues and marginal gingiva for signs of inflammation.

RESULTS

Parameter	Scores	Group 1 (n)	Group 1 (%)	Group 2 (n)	Group 2 (%)	p-value
OHI	Score 1	3	50.00%	5	83.30%	0.22
	Score 2	3	50.00%	1	16.70%	
BI	Score 1	3	50.00%	2	33.30%	0.56
	Score 2	3	50.00%	4	66.70%	
GI	Score 1	3	50.00%	4	66.70%	0.56
	Score 2	3	50.00%	2	33.30%	

Table 1: Comparison of different indices scoring between two groups using chi-square test

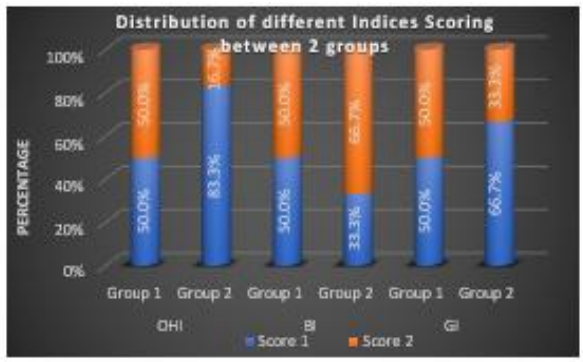
Parameter	Scores	Group 1 (n)	Group 1 (%)	Group 2 (n)	Group 2 (%)	p-value
Anatomical form	Bravo	3	50.00%	2	33.30%	0.56
	Charlie	3	50.00%	4	66.70%	
Marginal adaptation	Bravo	3	50.00%	3	50.00%	1
	Charlie	3	50.00%	3	50.00%	
Surface texture	Bravo	6	100.00%	4	66.70%	0.12
	Charlie	0	0.00%	2	33.30%	
Marginal discolouration	Bravo	1	16.70%	2	33.30%	0.51
	Charlie	5	83.30%	4	66.70%	
Colour match	Alpha	0	0.00%	6	100.00%	0.001*
	Charlie	6	100.00%	0	0.00%	
Interproximal contact	Bravo	6	100.00%	6	100.00%	..
	Charlie	0	0.00%	0	0.00%	
Recurrence of caries	Bravo	0	0.00%	0	0.00%	..
	Charlie	6	100.00%	6	100.00%	

Table 2 : Comparison of USPHS criteria between two groups using chi-square test

The results presented in Table 1 highlight a comparison of different indices scoring (OHI, BI, and GI) between two groups using the Chi-Square test. No significant differences were observed in any of the indices, as the p-values for OHI, BI, and GI were all greater than 0.05, indicating similar scoring distributions between the groups. Similarly, Table 2 provides a comparison of USPHS criteria between the two groups. Most parameters, including anatomical form, marginal adaptation, surface texture, and marginal discoloration, showed no statistically significant differences ($p > 0.05$). However, a significant difference was identified in the color match parameter ($p = 0.001$), where Group 2 had a higher percentage of "Alpha" scores (100%) compared to Group 1. Additionally, parameters such as interproximal contact and recurrence of caries exhibited uniform results with no variations across both groups.

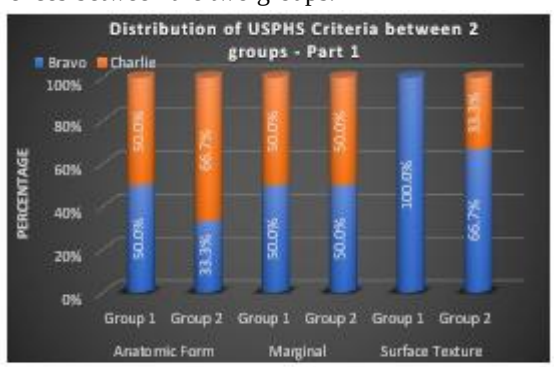
The OHI scores in Group 2 predominantly showed Score 1 (83.3%) compared to Group 1, which exhibited an equal distribution of Score 1 and Score 2 (50%). The Bleeding Index scores in Group 2 were primarily represented by Score 2 (66.7%) compared to Group 1, which also showed an equal distribution of Score 1

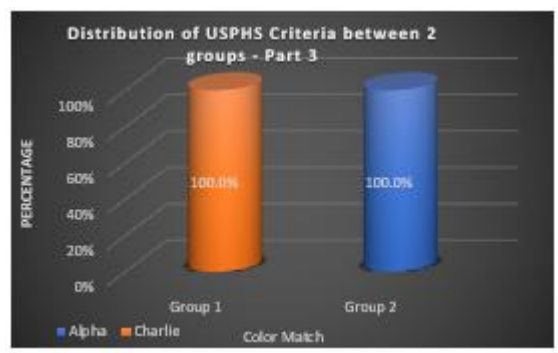
and Score 2 (50%). Similarly, the modified Gingival Index scores in Group 2 predominantly showed Score 1 (66.7%) compared to Group 1, which displayed an equal distribution of Score 1 and Score 2 (50%). However, the differences in the proportional distributions of these indices between the two groups did not demonstrate statistically significant differences.



Graph1: shows the distribution of indices between 2 groups

The Colour Match criteria of USPHS showed a significantly higher proportion of Alpha scores in Group 2 (100%) compared to Group 1, which exhibited 100% Charlie scores. This difference in the proportional distribution of Colour Match Criteria between the two groups demonstrated statistical significance with a p-value of 0.001. However, other USPHS criteria, including Anatomical Form, Marginal Adaptation, Surface Texture, Marginal Discoloration, Interproximal Contact, and Recurrence of Caries, did not show statistically significant differences between the two groups.





Graph 2: A - shows distribution of USPHS criteria between 2 groups part 1, B - shows distribution of USPHS criteria between 2 groups part 2, C - shows distribution of USPHS criteria between 2 groups part 3

DISCUSSION

This study evaluated the clinical outcomes of restoring primary upper incisors using Edelweiss crowns and omega loop intracanal posts. In recent years, the restoration of anterior primary teeth affected by caries has become a significant challenge in pediatric dentistry, with aesthetics being a primary concern. Achieving an aesthetically pleasing appearance for primary anterior teeth is complicated by factors such as small crown size, caries distribution, and patient cooperation.[6] Successful restoration often requires a retentive post to support the crown in the treated canal, but selecting the appropriate post remains challenging. Among the available options, omega posts and glass fiber posts have gained popularity in pediatric dentistry due to their excellent retention and aesthetic outcomes. In contrast, other commonly used posts, such as nickel-chromium cast posts, fail to meet aesthetic requirements and lack adaptability to the canal, while direct resin composite post buildup demonstrates inadequate long-term retention.

In this study, the USPHS criteria were utilized as a standardized and versatile method to evaluate the clinical performance of dental restorations. This framework, with its detailed scoring system, enables a comprehensive assessment of crowns while accommodating advancements in materials and techniques. Statistically nonsignificant differences were observed in six parameters at baseline and at 12 months, whereas significant differences were found in two parameters: the anatomical form of the crown and crown retention. Among the USPHS criteria, the Bioflix group showed the highest scores for color match compared to the Edelweiss group.[4,6]

Although omega posts may have some limitations in aesthetics, their primary advantage lies in avoiding internal stresses within the root canal, and they can be fabricated quickly chairside. In one case, an omega post dislodged three months after treatment and required refabrication, but it demonstrated satisfactory clinical results after six months. The omega loop technique, introduced by Mortada and King, is a simple and effective method. It involves placing omega loop wire extensions approximately 3-4 mm into the pulp chamber, with the loop's protruding section providing retention for the coronal restoration. This technique minimizes stress on the root canal and requires minimal chairside time, making it a cost-effective solution for restoring severely damaged primary anterior teeth. Additionally, the omega loop occupies only the cervical one-third of the canal, avoiding interference with deciduous root resorption or the eruption of permanent teeth.[2,7,8]

The Edelweiss posts, introduced by Edelweiss Dentistry (Austria), feature a prefabricated, tooth-colored, single-unit post and core system made from a nanohybrid composite material with an elastic modulus similar to dentin. These posts are designed to prevent wedging effects and ensure optimal fit in the canal, with antibacterial agents like barium glass, strontium, and zinc oxide embedded in the composite. The Edelweiss pediatric crowns are anatomically designed to mimic the natural form of primary teeth, requiring minimal tooth preparation and reducing the risk of pulp damage.[9] These crowns allow for quick, safe, and aesthetically pleasing restorations, with the added advantage of being easily removed if retreatment is necessary. Minimal occlusal adjustments are required, and any adjustments can be performed directly on the crown, preserving the opposing tooth structure.[6,10]

Studies such as those by Gupta et al. (2020) compared various tooth-colored crowns for parameters including marginal integrity, surface texture, discoloration, anatomical form, and secondary caries in deciduous anterior teeth over different follow-up periods. Their findings indicated that zirconia crowns performed the best, followed by Luxa crowns, while resin strip crowns showed secondary caries and poor marginal integrity.6 In the present study, Type I glass ionomer cement (GIC) was used for cementing the

crowns, aligning with research suggesting that GIC is cost-effective, time-efficient, and offers superior long-term retention compared to resin cements.[7]

While non-metallic posts like ceramic, polyethylene, and carbon fiber posts have been recommended for pediatric restorations, they often pose disadvantages such as being technique-sensitive, time-consuming, expensive, and requiring multiple steps.[11,12] Rifkin described the use of posts and crowns for restoring primary anterior teeth. However, this approach was not widely adopted due to concerns about potential interference with physiological root resorption, increased stress on the root canal, and the risk of root fracture if the post was forcibly fitted into a narrow canal.[13]

CONCLUSION

The evolution of posts, from cast metallic posts and preformed posts to aesthetic fiber post designs, was influenced by a variety of factors, one of which was the need for aesthetics. Along with this, functional harmony, biocompatibility, radiopacity, post-design, fracture resistance, reinforcement, cementation, and retention were factors that led to the search for the ideal post.
There was a variety of post materials and designs on the market, each produced to meet a particular demand. It was therefore up to the practitioner's professional judgment to select the post system that best fit the individual situation and techniques, which addressed the patient's functional and aesthetic demands and saved chair time, which was favorable during the treatment of very young children.

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Nil

CONFLICTS OF INTEREST

There are no conflicts of interest

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