

Abstract

Objective: This clinical trial aimed to evaluate the effectiveness of zirconia-based primary anterior crowns with and without retention grooves in children aged 2-6 years.

Methods: Children were randomly assigned to zirconia-based primary anterior crowns either with or without retention grooves. The clinical outcomes were evaluated based on gingival health, plaque index, secondary caries, crown failure, tooth wear of opposing teeth, and marginal integrity, at 2-weeks and recurring 6-month follow-ups. The study utilized the Early Childhood Oral Health Impact Scale (ECOHIS) to evaluate Oral-Health Related Quality of Life (OHRQOL) at baseline and 2-weeks along with parental satisfaction at 2 weeks and recurring 6-month follow-ups.

Results: In total, 38 crowns (23 with and 15 without grooves) were placed in twelve patients. At the 2week follow-up, there were no significant differences in clinical outcomes based on retentive grooves(P>.40). The most common negative clinical outcome was opposing tooth wear which was demonstrated in 7 (18%) crowns, 4 (27%) without grooves and 3 with grooves (13%). However, parents rated the crowns without grooves significantly better in terms of size (52% dissatisfied vs 0%; P =.0008), and marginally better for shape (P =.0634), color (P =.0634), and overall satisfaction (P=.0996). Bleeding around the crown and sensitivity was noted in two crowns without grooves.

Conclusion: Similar success was noted between the crowns (with and without retentive grooves) However, parents preferred crowns without grooves for size and showed marginal preference for shape, color, and satisfaction.

Introduction

Early childhood caries (ECC) is one of the biggest oral health problems in the world and the most common preventable childhood disease. Infants and children are most affected by it. It begins by affecting upper primary incisors. Caries on anterior teeth and the associated pain can affect a child's well-being, learning ability, and quality of life and have a negative impact on a child's emotional status, sleep pattern, speech development, and self-esteem. Therefore, prevention, management, and treatment of ECC is very important.¹ There are many treatment options available for restoring primary anterior teeth. A clinician's decision to opt for any specific treatment option is based on multiple factors such as the clinician's personal liking of a specific material or method, esthetic demands by parents, the child's behavior, and moisture and hemorrhage control. Patients with ECC are at higher risk of developing new or recurrent caries.² Therefore, it is best to treat ECC on primary incisors with full coverage coronal restorations.³

Out of many treatment options, Preformed Zirconia Crowns for primary teeth have been available since 2010. Zirconia crowns are strong, esthetically acceptable, and are biocompatible.³ There are different types of preformed pediatric zirconia crowns proposed by different manufacturers.⁴ They have shown less gingival bleeding and plague accumulation as compared to other anterior esthetic restorations in primary teeth.⁵ Zirconia Crowns manufactured by NuSmile differ from the ones manufactured by Sprig. Saliva contamination can adversely affect the bond strength of cement to Zirconia resulting in failure. NuSmile with its Try-In crown technology prevents contamination and increases the bond strength thus ensuring successful outcomes.⁶ Whereas with Sprig Zirconia crowns Precision-milled retention grooves are placed on the intaglio surface of a crown to increase the surface area. It provides mechanical undercuts to increase the bond strength of cement, which in turn helps the crown to lock into its place.⁷ There is insufficient research that compares anterior pediatric zirconia crowns with and without retentive grooves.



NuSmile Pink try in crowns

Effectiveness of zirconia-based primary anterior crowns with and without retention grooves: a randomized controlled trial

Alpna Khatri¹, Jayakumar Jayaraman², Caroline Carrico³, Samuel Srinivasan⁴, Caroll Caudill⁵, Sorin Uram – Tuculescu⁶. ¹Department of Pediatric Dentistry, School of Dentistry, Virginia Commonwealth University, Richmond, VA. ² Department of Pediatric Dentistry, School of Dentistry, Virginia Commonwealth University, Richmond, VA. ³Department of Biostatistics, Virginia Commonwealth University, Richmond, Virginia. ⁴Faculty of Dental Medicine and Oral Health Sciences, department in Montreal, Quebec, Canada, McGill University, Montreal, Quebec, Canada. ⁵Department of Pediatric Dentistry, School of Dentistry, Virginia Commonwealth University, Richmond, VA. ⁶Department of Prosthodontics, School of Dentistry, Virginia Commonwealth University, Richmond, VA.

Study Design: A parallel-arm RCT. Two arms: Crowns with and without retention grooves.

Inclusion criteria: Healthy 2 to 6-year-old children – healthy ASA status I or II. Those having opposing anterior teeth. No history of systemic illness or dental developmental anomalies. Minimal of two surfaces of caries in the upper anterior teeth. Patient with Early Childhood Caries (ECC). All genders were included. Patients were treated under general anesthesia. English, Spanish, and Arabic-speaking patients.

Exclusion Criteria: Teeth nearing exfoliation. The presence of a single surface caries, not involving the proximal surfaces. Teeth that have been subjected to trauma. Bruxism. Special health needs. Presence of teeth wear on the opposing teeth, or absence of opposing teeth.

• Sample calculation: A total of 150 teeth were aimed at being treated with zirconia-based primary anterior crowns: 75 with retentive grooves and 75 without retentive grooves.

• Interventions: The study recruited pediatric dental patients at Virginia Commonwealth University undergoing full-mouth dental rehabilitation (FMDR) under general anesthesia at the Children's Hospital of Richmond. Once eligibility was confirmed, parents or legal guardians were informed about the study, and written consent was obtained on the day of treatment. Patients were randomly assigned to receive zirconia crowns either with or without retention grooves. To assess oral health-related quality of life (OHRQoL), parents completed the Early Childhood Oral Health Impact Scale (ECOHIS) questionnaire, which evaluated the impact of dental health on both the child and family across multiple domains. The total ECOHIS score, ranging from 0 to 52, reflected OHRQoL, with higher scores indicating a poorer quality of life. If the number of missing responses fell within acceptable limits, an average score of the remaining responses was assigned to the missing items.

• Outcome Assessment: At the two-week follow-up, the provider conducted a comprehensive evaluation of the zirconia crowns using a clinical assessment form, examining key parameters such as anatomic form, gingival health, crown staining, surface roughness, opposing tooth wear, color match, marginal fit, and marginal discoloration. Each factor was categorized based on severity, ranging from normal to severe conditions. Additionally, parental satisfaction was assessed through a five-point questionnaire evaluating size, shape, color, durability, and overall experience. Parents also reported any post-treatment issues, such as bleeding, sensitivity, or food impaction. The collected data provided valuable insights into the clinical performance of zirconia crowns and parental perception, aiding in future treatment improvements and patient care strategies.

• Statistical Analysis: A Fisher's Exact Test with a 5% two-sided significance level will have 92.8% power to detect the difference between a group 1 proportion, π_1 , of 0.75 and a group 2 proportion, π_2 , of 0.95 when the sample sizes in each group is 75.





Methods

In total, 38 crowns (23 with and 15 without grooves) were placed in twelve patients. At the 2-week follow-up, there were no significant differences in clinical outcomes based on retentive grooves (P>.40). The most common negative clinical outcome was opposing tooth wear which was demonstrated in 7 (18%) crowns, 4 (27%) without grooves and 3 with grooves (13%). However, parents rated the crowns without grooves significantly better in terms of size (52% dissatisfied vs 0%; P = .0008), and marginally better for shape (P = .0634), color (P = .0634), and overall satisfaction (P=.0996). Bleeding around the crown and sensitivity was noted in two crowns without grooves.

Table 1: Clinical Outcomes Evaluated at 2-week Follow-up (n=38)

Crowns)	All Crowns		With Grooves		Without Grooves		
	Optimal	Suboptimal	Optimal	Suboptimal	Optimal	Suboptimal	Р
<u>Anatomical</u>							
<u>form of Crown</u>	36 (95%)	2 (5%)	22 (96%)	1 (4%)	14 (93%)	1 (7%)	>0.999
<u>Gingival Health</u>	38 (100%)	0 (0%)	23 (100%)	0 (0%)	15 (100%)	0 (0%)	>0.999
<u>Staining of</u>							
<u>Crown</u>	36 (95%)	2 (5%)	22 (96%)	1 (4%)	14 (93%)	1 (7%)	>0.999
<u>Surface</u>							
<u>roughness</u>	38 (100%)	0 (0%)	23 (100%)	0 (0%)	15 (100%)	0 (0%)	>0.999
Opposing tooth							
wear	31 (82%)	7 (18%)	20 (87%)	3 (13%)	11 (73%)	4 (27%)	0.4008
Color match of							
<u>crown</u>	38 (100%)	0 (0%)	23 (100%)	0 (0%)	15 (100%)	0 (0%)	>0.999
Marginal fit	36 (95%)	2 (5%)	21 (91%)	2 (9%)	15 (100%)	0 (0%)	0.5092
Marginal							
discoloration	38 (100%)	0 (0%)	23 (100%)	0 (0%)	15 (100%)	0 (0%)	>0.999

Table 2: Parental Satisfaction Responses at 2-week Follow-up (n=38 Crowns)

	All Crowns		With Grooves		Without Grooves		
	Satisfied	Dissatisfied	Satisfied	Dissatisfied	Satisfied	Dissatisfied	Р
Size	26 (68%)	12 (32%)	11 (48%)	12 (52%)	15 (100%)	0 (0%)	0.0008
Shape	32 (84%)	6 (16%)	17 (74%)	6 (26%)	15 (100%)	0 (0%)	0.0634
Color	32 (84%)	6 (16%)	17 (74%)	6 (26%)	15 (100%)	0 (0%)	0.0634
Durability	28 (88%)	4 (13%)	13 (76%)	4 (24%)	15 (100%)	0 (0%)	0.1041
Overall							
Satisfaction	26 (87%)	4 (13%)	11 (73%)	4 (27%)	15 (100%)	0 (0%)	0.0996
_	Yes	No	Yes	No	Yes	No	
Bleeding							
around							
<u>crown</u>	1 (3%)	35 (97%)	0 (0%)	23 (100%)	1 (8%)	12 (92%)	0.3611
<u>Sensitivity</u>	1 (3%)	35 (97%)	0 (0%)	23 (100%)	1 (8%)	12 (92%)	0.3611
Food							
Impaction	0 (0%)	36 (100%)	0 (0%)	23 (100%)	0 (0%)	13 (100%)	>0.999

At the two-week follow-up, this clinical study found no significant difference in success rates between anterior zirconia crowns with and without retentive grooves. However, the most notable adverse outcome was opposing tooth wear in NuSmile zirconia crowns. While clinical performance remained comparable between the two crown types, parents preferred crowns without grooves for size and showed a marginal preference for shape, color, and satisfaction. Additionally, minimal occurrences of bleeding and sensitivity were reported in crowns without grooves. These findings align with existing literature supporting the clinical acceptability of zirconia crowns while emphasizing the importance of esthetic considerations in parental satisfaction.

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Results

Conclusion

References