

Clinical Outcomes of Primary Anterior Esthetic Crowns in Pediatric Dentistry: A prospective cohort study

Jenan Alahmad, B.D.S Candidate¹, Parthasarathy Madurantakam, D.D.S., M.D.S., Ph.D.²,
Caroline Carrico, Ph.D.³, Aous Abdulmajeed, D.D.S., Ph.D.², Paula L Coates, D.D.S., M.S.¹

¹Department of Pediatric Dentistry, ²Department of General Practice, ³Department of Dental Public Health and Policy, School of Dentistry, Virginia Commonwealth University, Richmond, VA

Abstract

Clinical Outcomes of Primary Anterior Esthetic Crowns in Pediatric Dentistry: A Prospective Cohort Study

Jenan Alahmad¹, Parthasarathy Madurantakam², Caroline Carrico³, Aous Abdulmajeed², Paula Coates¹,

¹ Department of Pediatric Dentistry, School of Dentistry, Virginia Commonwealth University, Richmond, VA, ² Department of General Practice, School of Dentistry, Virginia Commonwealth University, Richmond, VA, ³ Department of Dental Public Health and Policy, School of Dentistry, Virginia Commonwealth University, Richmond, VA

Objective:

This prospective cohort study aimed to compare the effectiveness of restoring maxillary anterior teeth in children (aged 3-6 years) with three different materials: Zirconia Crowns (ZC), Resin Composite Crowns (RC), and Pre-veneered Stainless-Steel Crowns (PVSSC). The study aims to assess the Oral Health-Related Quality of Life (OHRQoL) in children receiving full coronal restorations in primary anterior teeth.

Methods:

The study was approved by the VCU Institutional Review Board (HM #20024519). A total of 114 children diagnosed with early childhood caries were enrolled, and 79 teeth were restored with ZC, RC, or PVSSC under general anesthesia. The performance of crowns was assessed based on retention, fracture, color change, marginal integrity, mobility, and periapical pathology. The study utilized the Early Childhood Oral Health Impact Scale (ECHOIS) to evaluate OHRQoL at intervals of 0, 6, and 12 months.

Results:

At 6-month follow-up, 79 crowns were evaluated, including 14 PVSSCs (18%), 15 ZCs (19%), and 50 RCs (63%), out of which 97% of crowns remained retentive. Fracture were observed in 13% of crowns and were not significantly associated with the crown type ($P=0.925$). Gingival inflammation was observed at the site of 9 crowns (11%) and was significantly more common with PVSSCs (29%) and ZC (33%) than RC (0%) ($P<.0001$). Child Impact scores decreased by an average of 1.6 points (95% CI: -0.75, 3.94) and Family Impact by an average of 0.40 (95% CI: 0.43, 1.22)

Conclusion:

Most crowns were retained at a 6-month with minimal fracture. Gingivitis was primarily observed at the site of the ZC and PVSSC crowns. Enhancement of OHRQoL was observed at the follow-ups for all crown types.

Introduction

Early childhood caries (ECC) has been a serious concern in the primary dentition of pediatric patients for many years, posing a significant challenge in its management. ECC is a dental condition characterized by its acute and rapid onset, typically manifesting first in the cervical region of the maxillary anterior primary dentition. It is most frequent in children around 18 to 36 months, though it can occur at a younger age.

Primary teeth pose certain characteristics that differ from permanent dentition, such as small clinical crowns, the relatively large size of the pulp chamber, the proximity of pulp horns to the interproximal surface, and thin enamel. These characteristics necessitate clinicians to practice careful teeth preparation and material placement.

There are different types of full coverage restorations for anterior primary teeth, and that include Zirconia Crowns (ZC), Resin Strip Crowns, (all-surface resin composite crowns) (RC), and Pre-veneered Stainless-Steel Crowns (PVSSC). Each of these crowns has its own technique, advantages, and limitations.

This prospective cohort study was intended to compare Zirconia Crowns (ZC), Pre-veneered Stainless-Steel Crowns (PVSSC), and Resin Strip Crowns (RC) in primary anterior teeth for pediatric patients who undergo general anesthesia. This study aims to confirm the validity of restorative options for anterior teeth, find weak points to address, improve techniques, address any causes of failure, add to the available literature on anterior crowns, and find any areas that require further research.

The concept of oral health-related quality of life (OHRQoL) carries significant weight in dentistry and dental research. OHRQoL is acknowledged by the World Health Organization (WHO) as a vital component of global health. The Early Childhood Oral Health Impact Scale (ECHOIS) is a specialized tool designed in 2007 by Pahel et al. for young children to evaluate the effects of oral health problems on both preschoolers and their families. This study aims to utilize the OHRQoL questionnaire to determine the ECHOIS for children who receive full coverage anterior esthetic restorations.

Materials & Methods

The research was a prospective cohort study designed to collect data on two occasions: at baseline and at six months. A total of 114 participants were recruited during VCU pediatric dental clinic treatment planning consultation visit, and in the preoperative anesthesia care unit (PACU) at VCU Children's Pavilion and Children's Hospital of Richmond at Brook Rd.. Parents/legal guardians were recruited in the study to evaluate and assess the maxillary anterior crowns the patient would receive and to answer thirteen survey questions on Oral Health-Related Quality of Life (OHRQoL), determined by the Early Childhood Oral Health Impact Scale (ECHOIS).

Inclusion criteria included patients aged between 36-72 months old who were physically classified as ASA I or II, maxillary anterior teeth with more than one carious surface, with healthy pulp or reversible pulpitis, no signs or symptoms of pathology, and who is medically qualified to receive treatment under general anesthesia. At the follow-up visits, the providers examined the crowns, checking retention, fracture, change in color, margin fit, and mobility.

Both the clinical examination and the OHRQoL questionnaire were completed at baseline and at a 6-month recall visit. Clinical results and survey answers were input into Research Electronic Data Capture (REDCap) software for final analysis.

Statistical Methods

Results were summarized using descriptive statistics: count and percentages for categorical variables and median, IQR (interquartile range) for the Early Childhood Oral Health Impact Scale scores (ECHOIS) due to the skewness in the data. The prevalence of crown outcomes was compared across the crown type using Fisher's exact test. Differences in ECHOIS scores between GA and 6-month follow-up were compared using Wilcoxon signed-rank tests. The significance level was set at 0.05. SAS EG v.8.2 (SAS Institute, Cary, NC) was used for all analyses.

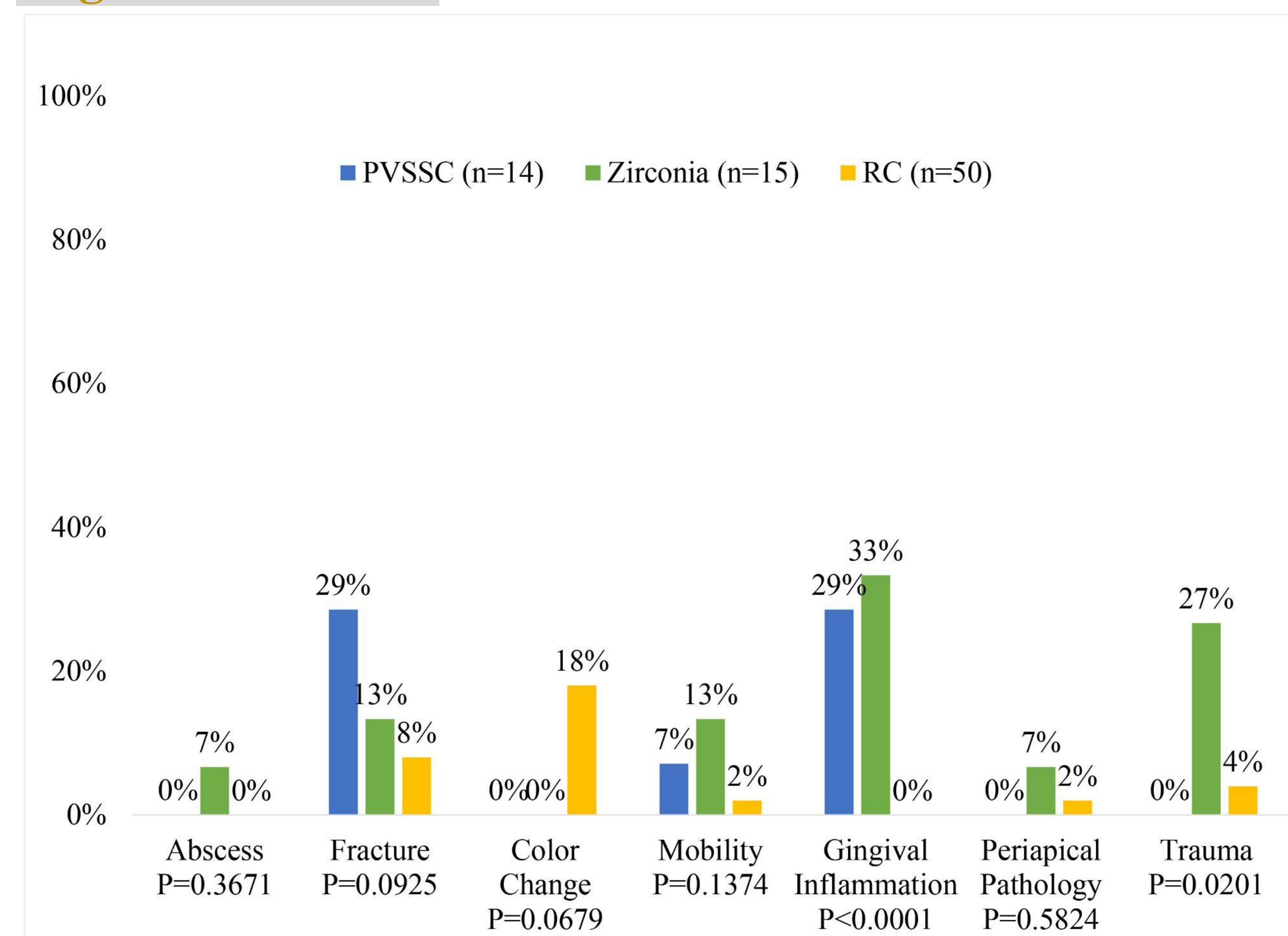
Patient and Crown Characteristics

	Mean	SD
Age	4	1.39
	n	%
Gender		
Male	17	59%
Female	12	41%
Teeth Treated		
C	6	21%
D	19	66%
E	14	48%
F	16	55%
G	19	66%
H	5	17%
Crown Type		
Zirconia	15	19%
Resin Strip Crown	50	63%
Pre-veneered SSC	14	18%
Number of Teeth Treated		
1	5	17%
2	9	31%
3	5	17%
4	9	31%
5	1	3%

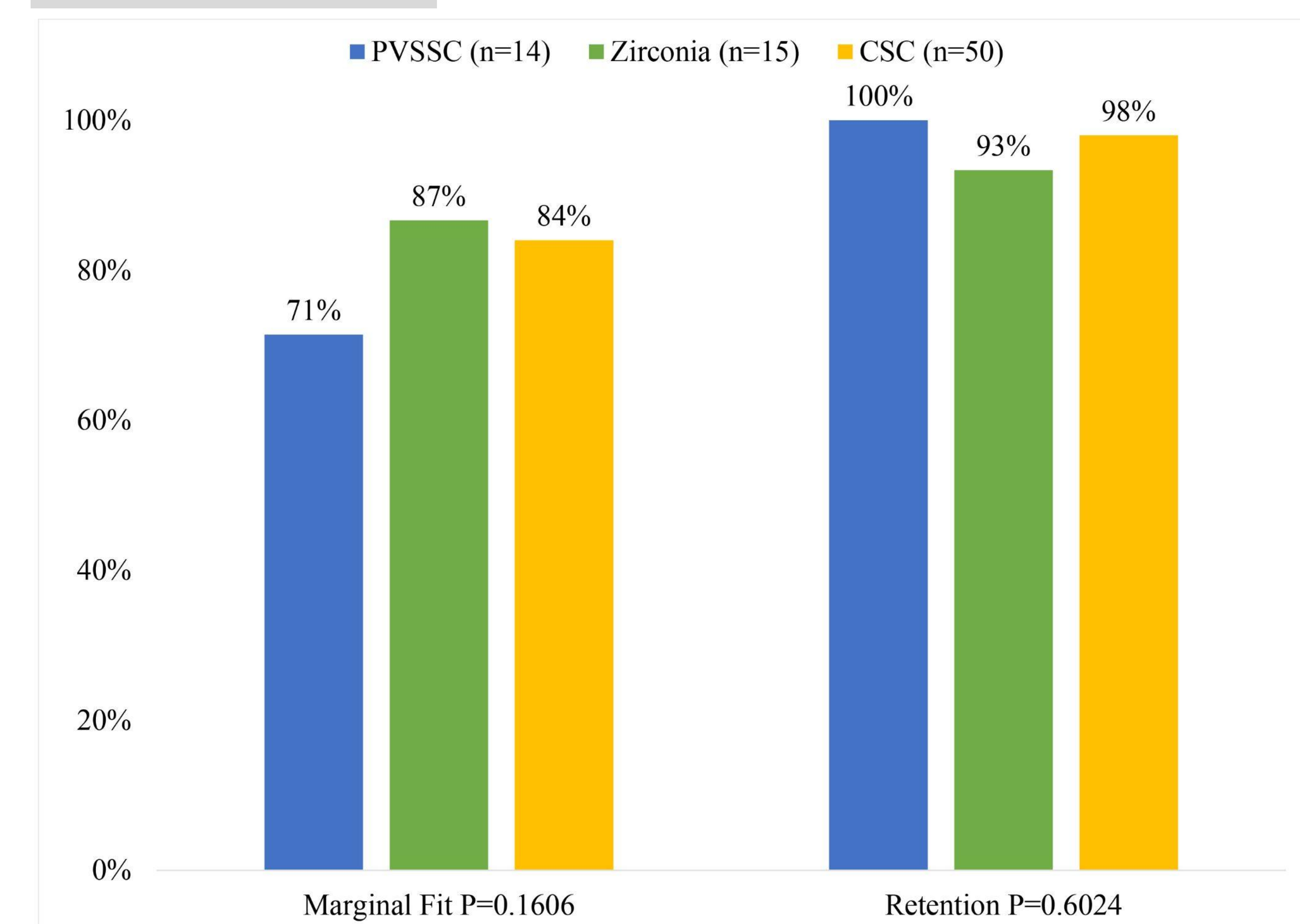
Table 1: Summary of Patients and Crowns

Clinical outcomes of the crowns at 6 month follow-up

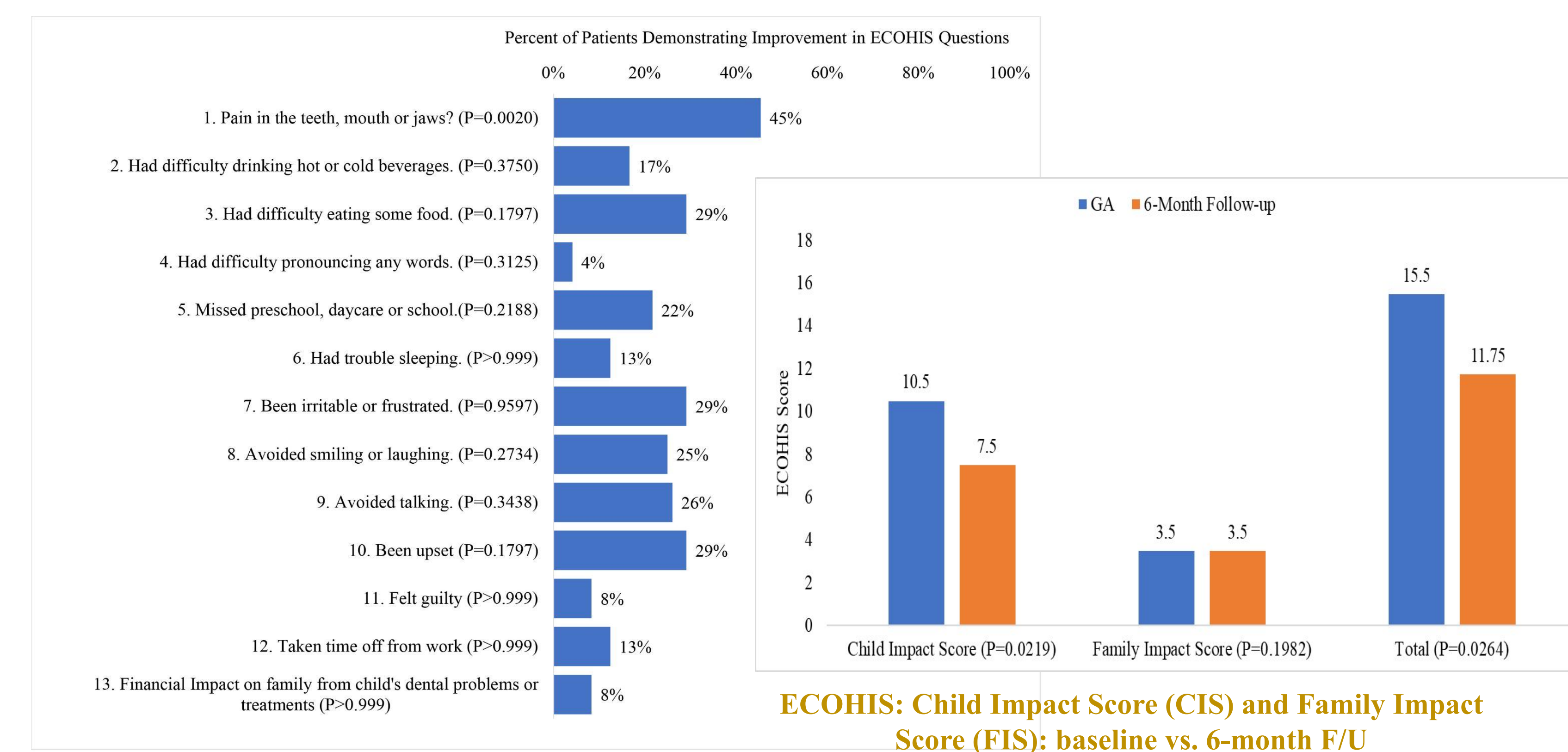
Negative outcomes



Positive outcomes



Oral Health-Related Quality of Life results



ECHOIS: Child Impact Score (CIS) and Family Impact Score (FIS): baseline vs. 6-month F/U

Discussion

Retention of crowns

Nearly all crowns were retained during the 6-month follow-up period at 97.5%. Retention of the crown types 100%, 98% and 93% for PVSSC, RC, and ZC, respectively. The results of our study are similar to the available literature with high retention and success of maxillary anterior crowns of all types.

Marginal fit

In this study, 82% of crowns displayed satisfactory marginal integrity. Interestingly, 13 out of 15 ZC demonstrated 87% rate of marginal integrity, outperforming RC and PVSSC.

Gingival health

Highest incidence of gingival inflammation with ZC and PVSSC, at 33% and 29%, respectively, when RC showed no gingival inflammation. Our results contradict the available literature on ZC.

Color change

In our study, ZC and PVSSC exhibited no color changes after 6 months of follow-up, RC (9/50, 18%) of the crowns showed slight color mismatch.

Fracture

PVSSC demonstrates the highest incidence veneers fractures, which is a common characteristic observed in this type of crown.

Periapical pathology & Abscess

we found that clinical abscess was the lowest among all other variables. Only 1 out of 79 crowns had intraoral abscess, which was noted with ZC at 7%.

Trauma

Patients with RC and ZC reported trauma to the maxillary anterior teeth while no trauma was noted for PVSSC in the current study.

OHRQoL

Significant decrease in the Child Impact Score, which translates to increased OHRQoL. No statistical significance was found among crown types, likely attributable to the small sample size. Family Impact Score, which measures parental burden of the disease, remained constant with no changes.

Conclusion

- PVSSC crowns have proven to be clinically successful restorations for anterior primary teeth despite occasional issues such as chips and fractures of the facial veneer and gingival inflammation. Nevertheless, the retention of these crowns remained excellent after 6 months of placement.
- ZCs exhibit excellent esthetics and marginal continuity; however, upon 6-month follow-up, some instances of gingival inflammation around the crowns were observed.
- While RCs demonstrated no gingival issues around the crowns following 6 months of treatment, color changes were observed in the restoration.
- Following treatment, there has been a significant improvement in OHRQoL, accompanied by a notable decrease in the Child Impact Score.

Acknowledgments

I would like to express my deepest gratitude to my principal investigator, Dr. Parthasarathy Madurantakam, for his invaluable guidance, support, and encouragement throughout the entire process of completing this research. His expertise, insights, and constructive feedback have been instrumental in shaping the direction and quality of this study.

I am also thankful to the members of my thesis committee, Dr. Caroline Carrico, Dr. Paula Coates, and Dr. Aous Abdulmajeed, for their valuable input, suggestions, and critical review of this work.

Additionally, I extend my gratitude to my thesis advisor, Dr. Jayakumar Jayaraman, for his guidance, time, and willingness to share his experience and insights.

My sincere appreciation goes to my co-residents, the attending faculties, and the dental assistants for their help and participation in making this research possible.

Special thanks are extended to my late father, my mother, my siblings, and my friends for their unwavering support, understanding, and encouragement throughout this journey.

(References available upon request)