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The Effect of Pulp Treatments on the Survival of Zirconia Crowns in Primary Teeth

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Research Article

History

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ABSTRACT

Objectives: This study evaluated the effect of pulp treatment on the survival rate of zirconia crowns (ZCs) placed in primary anterior teeth of children under general anesthesia.
Materials and Methods: A total of 80 anterior teeth of 32 children aged 18-60 months who underwent ZCs under general anesthesia were followed for 18 months. Failure cases of were categorized. Statistical analysis included independent sample t-test, chi-square test, and Kaplan-Meier survival method.
Results: There was no difference in survival of ZCs between pulp treated and untreated teeth (p>0.05). Considering the survival time of ZCs according to the presence or absence of pulpal symptoms, it was observed that 4 out of 80 teeth were symptomatic (with or without crown loss) at the end of 18 months, and the success rate was 95%.
Conclusions: Pedodontic ZCs had a high survival rate in anterior primary teeth in children treated under anesthesia.

Key words: General Anesthesia, Primary Teeth, Zirconia Crown.

Süt Dişlerinde Zirkonyum Kuronların Sağ Kalımı Üzerine Pulpa Tedavilerinin Etkisi

Süreç

Geliş: 06/07/2023
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ÖZ

Amaç: Bu çalışma, genel anestezi altındaki çocukların süt ön dişlerine yerleştirilen zirkonya kruonların sağ kalım oranına pulpa tedavisinin etkisini değerlendirdi.
Gereç ve Yöntemler: Genel anestezi altında zirkonyum kuron uygulanan 18-60 aylık 32 çocuğun toplam 80 ön dişi 18 ay takip edildi. Zirkonyum kuronların başarısızlık vakaları kategorize edildi. İstatistiksel analiz bağımsız örneklem t-testi, ki-kare testi ve Kaplan-Meier sağ kalım yöntemini içermiştir.
Bulgular: Zirkonyum kuronların sağ kalımında pulpal tedavisi olan veya olmayan dişler arasında önemli derecede fark yoktu. Semptomların varlığına veya yokluğuna göre zirkonyum kuronların hayatta kalma süresine bakıldığında, 18 ay sonunda 80 krondan sadece 4'ünün semptomatik olduğu (kron kaybı olsun veya olmasın) gözlendi ve başarı oranı %95 idi.
Sonuçlar: Pedodontik zirkonyum kuronlar, anestezi altında tedavi edilen çocuklarda anterior süt dişlerinde yüksek sağ kalım oranına sahipti.

Anahtar Kelimeler: Genel Anestezi, Süt Dişleri, Zirkonyum Kuron.

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Introduction

Dental caries, which is an important public health problem, is one of the most common chronic diseases in childhood.[1] In a study conducted in Turkey in 2004, the prevalence of caries in 5-year-old children was 69.8%; It has been reported as 61.1% in children aged 12 years.[2] Since the enamel in deciduous teeth is structurally different from that of permanent teeth, caries in deciduous teeth progress faster than in permanent teeth. In particular, primary incisors may need treatment due to dental caries as well as trauma or developmental defects. There are different treatment options and different materials that can be used for the restoration of these teeth. The choice of the treatment applied and the material used; It is affected by many factors such as the amount of remaining tooth structure, isolation conditions, aesthetic expectations and the level of compliance of the patient.[3]

There are many materials used in full coronal restorations of primary incisors from past to present. Resin strip crowns, preveneer stainless steel crowns, open-face stainless steel crowns and prefabricated zirconia crowns (ZCs) are among the recommended treatment approaches.[4] Previous researches have determined that the failure rate of composite resins placed under general anesthesia is up to 45%.[5,6] Today, with the demands of parents and children, the need for aesthetic restorations is increasing day by day.[7] In a previous study on the preferences of children and parents in the selection of restorative materials, it was determined that tooth-colored materials were preferred the most.[8]

In recent years, ZCs have attracted more attention than other treatment options in primary anterior teeth with excessive material loss, due to both meeting aesthetic expectations and high mechanical strength.[9] Various studies have been conducted on ZCs used in anterior primary teeth with excessive material loss. In a study by Holsinger et al.[10] in which they evaluated the success of ZCs made under general anesthesia and sedation, retention values were found to be 96% at the end of 20 months. Likewise, Seminario et al.[11] in their study evaluating the survival of ZCs performed under general anesthesia, they determined the survival rates at the end of 12 and 36 months as 93% and 76%, respectively. Although there are several other studies showing the survival rates of ZCs, data from clinical studies are insufficient.

It is not possible to treat children with complicated and multi-interventional teeth in the clinic conditions. Children who have high anxiety and anxiety, especially children before the age of 6, and children with systemic diseases and/or disabilities are difficult patients in terms of performing dental procedures in a clinical setting in a harmonious manner.[12] Pediatric dentists can perform their treatments under general anesthesia in such cases. General anesthesia application in pediatric dentistry; It is frequently used in patients with early childhood caries and severe early childhood caries.[13-15] It is noteworthy that the application of dental general anesthesia has increased in the last 10 years, and this increase is especially in the 3-6 age group.[16]

This study evaluated the effects of factors such as age, gender and pulp treatments on the survival of ZCs applied to the anterior teeth of children under general anesthesia. The null hypothesis of the study is that pulp treatments, which are among the factors, have no effect on success and survival in teeth with ZCs.

Material and Methods

Ethical approval for the study was obtained from Nevşehir Hacı Bektaş Veli University Ethics Committee (no:2023/189).

Sample Selection

Between October 2020 and October 2021, severe early childhood caries were diagnosed and dental treatments were performed under general anesthesia in a private hospital in Kayseri; The files of patients younger than 60 months who used one or more ZCs in their treatment were scanned, and information about follow-up appointments and visit information of the children who met the inclusion criteria were recorded. During the 18-month follow-up, the data on the success or failure of the restorations of the patients who came to the control appointment at 6-month intervals were recorded. (Figure 1)

The condition of the crown was classified using the following criteria; accordingly, crown survival has been noted to be unsuccessful if one of the following conditions is observed.

a) No clinical failure
b) Debonding without complication: debonding of crown but no pulp-related pain or abscess in the patient
c) Debonding with complication: debonding of the crown and the patient's complaints such as pulp-related pain, abscess and tooth mobility
d) Failure without debonding: the crown not debonded, but the patient has clinical symptoms such as toothache, food impaction, abscess, tooth mobility

The survival of crowns was recorded at the end of the one-and-a-half year follow-up (18 months), during the follow-up period when debonding and pulpal failure were first noticed (6, 12, or 18 months).

Independent t-test and chi-square test were used to compare differences in parametric variables (age) and non-parametric variables, respectively. Kaplan-Meier survival curves were obtained for the effect of pulp treatment on the success of ZCs. Statistical analyzes were performed in SPSS 21.0 (IBM Corp., Armonk NY, USA) statistical program at 5% significance level.

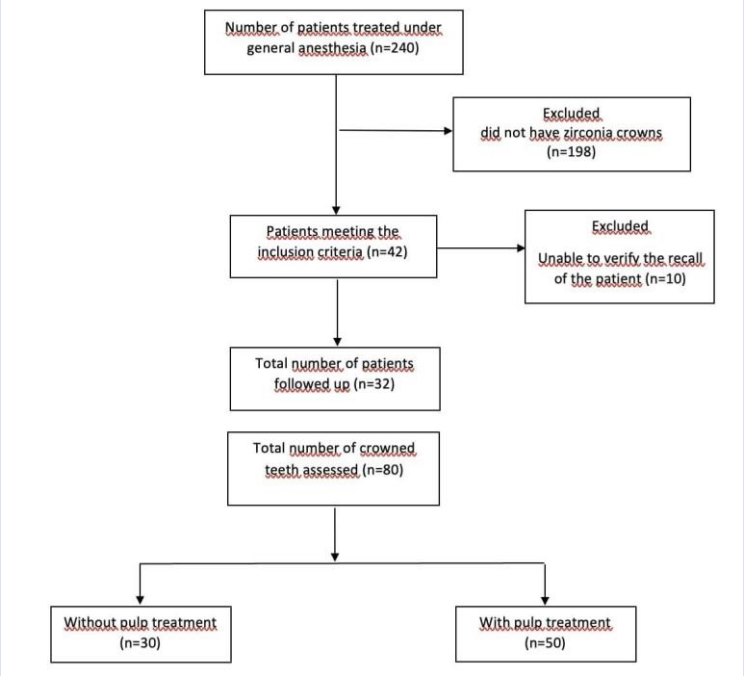

Figure 1: Study flowchart

Table 1. Types of failure according to the presence of pulp treatment

		Pulp Treatment		
		No	Yes	Total
Failure	***No clinical failure***	27	41	68
	Debonding without complication	3	5	8
	Debonding with complication	0	3	3
	No debonding	0	1	1
		30	**50**	**80**

Table 2. Types of failure observed.

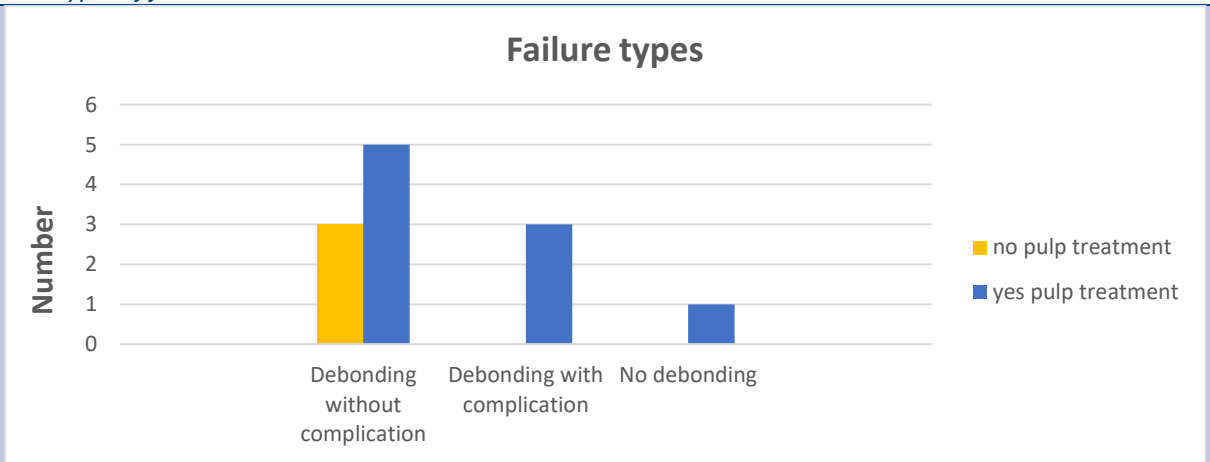

Figure 2: Kaplan–Meier survival curve for mean survival time of zirconia crowns.

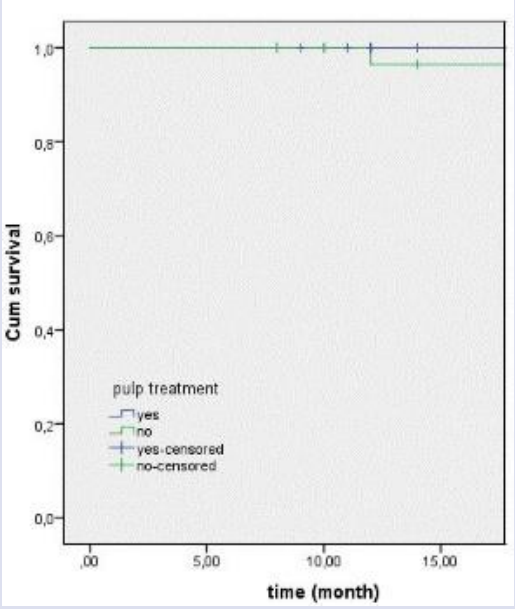

Figure 2: Kaplan–Meier survival curve for mean survival time of zirconia crowns.

Results

The sample consisted of 32 patients (15 girls, 17 boys) aged between 18-60 months (mean 38 months). There was no significant difference in the success of ZCs in terms of gender and age ($p>0.05$). Pulp treatment (50 patients) was applied to a significant majority of the 80 teeth examined before crown application (Table 1). Most of them were treated with pulpectomy (38 patients), while pulpotomy (12 patients) was applied to the others. Debonding was the most common cause of failure, while pulpal failures were recorded only in teeth that underwent pulp treatment.

Of the 80 crowns observed over a one-and-a-half year period, 12 were recorded as clinically unsuccessful, however, there was an overall survival rate of 85%. Debonding failure was the dominant failure type (n =11) (Table 2). Failure without debonding of the crown occurred in only 1 patient, which also occurred in the pulpal treated group and as a result of dental trauma. It was observed that the mild pain and mobility observed in the first control of the involved tooth disappeared in the ongoing follow-up appointments. Likewise, failure in 3 patients with pulpal complications and debonding was also the result of dental trauma. And these 3 patients were from the pulpal treated group, and 2 of the debonded crowns were re-cemented in the clinical setting. However, crown cementation could not be performed in 1 patient due to very young age and insufficient cooperation.

Looking at the survival time of ZCs according to the presence or absence of symptoms, only 4 out of 80 ZCs were observed to have pulpal symptoms (with or without crown loss) after 18 months. Survival functions for pulp-treated and non-pulp-treated crowns were plotted using Kaplan-Meier survival charts (Figure 2). The survival rate for ZCs with pulp treatment was 82%, while the survival rate for ZCs without pulp treatment was 90%. There was no statistically significant difference between the survival of ZCs with and without pulp treatment ($p>0.05$).

Discussion

With the increasing public awareness of aesthetics, the demands of parents for tooth-colored restorations have increased.[4] For primary incisors, tooth-colored restorations that completely cover the tooth have their own advantages and disadvantages.[17] Composite strip crowns, which have been used for a long time in aesthetic restorations of primary incisors, offer advantages such as diversity in color options, allowing multiple dental treatments and ease of repair; Difficulties in providing saliva and blood isolation during application and contamination sensitivity of the technique are among the disadvantages.[18,19] On the other hand, when the veneered stainless steel crowns are compared with the strip crowns; It can be listed as an advantage that they are less affected by saliva and blood contamination, which may affect the retention, color and resistance of the crown, and that they require less time for treatment.[20] However, it requires too much tooth cutting, deterioration of adaptability in multiple dental treatments, and fractures that occur in the inflexible veneer structure are among its disadvantages.[21]

Prefabricated pediatric ZCs, on the other hand, were developed to be an aesthetic alternative to stainless steel crowns and veneered stainless steel crowns, which are considered the gold standard in full coronal restorations of primary teeth. There is no cooperative tendency for restorative treatments due to insufficient cognitive skills in young children with high early childhood caries. It is possible to prevent failures that may occur in dental treatments at this age, in treatment conditions such as sedation or general anesthesia where stabilization can be achieved definitively. The children included in our study had early childhood caries and were in the younger age group. Therefore, their treatment was completed under general anesthesia.

When the literature is reviewed, there are studies that evaluate the clinical performance of prefabricated pedodontic ZCs and compare them with other restorative materials.[22,23] However, there is limited information regarding the effect of pulpal treatments on the survival of pedodontic ZCs. Therefore, in our study, the effects of pulpal treatments on the survival of ZCs, as well as factors such as age and gender, were evaluated.

Yanover et al.[24], in their study in which they followed the success of pedodontic ZCs for more than 30 months; They stated that it is a satisfactory treatment option for decayed primary maxillary incisors in terms of marginal integrity, gingival health and aesthetics. Gill et al.[25], reported that ZCs were clinically acceptable in a 12-month follow-up study conducted in children aged 2 to 4 years, showing that they showed high survival and marginal integrity.

Although there are studies suggesting pulpal treatment of teeth to be crowned, there is no need to perform pulpal treatment before placing ZCs on teeth where dental caries does not reach the pulp. In primary teeth, clinical examination is the only way to accurately determine the pulp status of the tooth.[26] Therefore, in our study, it was decided whether pulp treatment would be performed or not, whether pulp exposure was observed after caries removal.

Our findings showed that there was no difference in the survival of ZCs applied to pulp treated and untreated teeth. It can be thought that crown retention may be less than the group without pulp treatment, since teeth requiring pulp treatment have more material loss due to deep caries. As a matter of fact, in a previous study[27], they revealed that crown loss was higher in teeth that had pulpal treatment. However, there was no difference in our study; It can be attributed to increasing the retention of the crowns by compensating the tissue losses in pulpal treated teeth with filling materials with high adhesion strength before the ZCs is placed.

In our study, the survival rate of ZCs was 85%. In a previous study[28], clinical performance of ZCs and composite strip crowns was followed for 18 months. According to the study findings, ZCs gave more satisfactory results in terms of retention and restoration success than composite strip crowns. Retention success of ZCs was 100%, whereas that of strip crowns was 77.8%.

Some limitations should be considered when evaluating the results of our study. This study was conducted retrospectively and therefore results may not be as strong as those from split mouth clinical studies. However, the Kaplan-Meier survival curve has been shown to be a valid tool for predicting the success of restorations used in children. The role of oral hygiene on the survival of crowns was a factor not evaluated in our study. In addition, the limited number of patients included in the study can be considered as one of the limitations of the study. Despite these limitations, this study provides clinicians with an insight into the impact of pulpal treatments on the survival of ZCs.

Conclusions

ZCs applied under general anesthesia in uncooperative children have a high survival rate in teeth with or without pulpal treatment. In the future, clinical studies with longer follow-up periods are needed to evaluate the effects of different variables on the survival of ZCs in primary teeth.

Conflicts of Interest Statement

The authors deny any conflicts of interest related to this study.

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