

A Clinical Study to assess and Compare the Clinical Efficacy and Level of Satisfaction among Parents for Their Children using Stainless Steel and Zirconia Crowns for Primary Molars

Gaytri Kumari¹, Anupma Choudhary²

¹Post Graduate Trainee, Department of Paediatrics, and Preventive Dentistry, Mithila Minority Dental College and Hospital, Darbhanga, Bihar, India

²Post Graduate Trainee, Department of Paediatrics, and Preventive Dentistry, Mithila Minority Dental College and Hospital, Darbhanga, Bihar, India

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Corresponding Author: Dr. Anupma Choudhary

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Abstract

Aim: The aim of the present study was to evaluate and compare the clinical success and parental satisfaction for stainless steel and zirconia crowns in primary molars.

Methods: This prospective randomized controlled trial was designed as a split-mouth study. which exfoliation was imminent, tooth with internal resorption, and tooth with acute infection at Mithila Minority Dental College and Hospital, Darbhanga, Bihar, India. The patients with bilateral pulp therapy treated teeth were randomly divided into two groups by coin toss in which group I consisted of 50 primary second molars which would receive SSC (3M ESPE, Minneapolis, USA) and group II consisted of 50 primary second molars which would receive zirconia crowns (Kinder Crown, Minneapolis USA).

Results: Both SSC and zirconia crowns achieved a clinical success rate of 100% during the study period. This was determined by evaluating factors such as crown retention, modified gingival index, stain resistance, gingival marginal extension, occlusion, and proximal contact at placement. The only difference between the two crowns was in the plaque index. The level of parental satisfaction was equivalent for both groups in regards to the factors of shape, size, retention, durability, and overall satisfaction. Out of the total number of parents surveyed, only 21 (42%) expressed satisfaction with the color of SSC, while all 50 parents (100%) were delighted with the color of zirconia. A highly significant statistical difference ($P < 0.001$) was observed between the groups. There was no change in the parental perspective over the duration of the investigation. Every single one of the 50 patients (100%) expressed satisfaction with the zirconia crowns, but only 27 out of the patients (54%) were satisfied with SSC. There was a substantial statistical disparity ($P < 0.001$) between both groups.

Conclusion: Stainless steel crowns continue to be considered the "Gold Standard" for fully covering the back teeth in primary molars. This is because they require a simpler crown preparation process and are less expensive than zirconia crowns. Zirconia crowns, despite their esthetic appeal, require a more invasive crown preparation procedure, necessitate the use of local anesthesia, and are time-consuming. Consequently, they are not often approved by parents and patients.

Keywords: Clinical success, primary molars, stainless steel crowns, zirconia

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Introduction

Childhood dental caries is a substantial public health concern. In the present era, since the occurrence of tooth decay is becoming more common, it is crucial to preserve the proper functioning of the baby teeth by carrying out different types of dental restoration procedures. [1] Preformed metal crowns (PMCs), also known as SSCs, are an excellent option for treating large cavities, especially in primary molars. [2] Stainless steel crowns have several benefits, but they are not aesthetically pleasing. As a result, alternative materials including open-faced crowns

and pre-veneered SSCs have been developed to replace them. These materials enhance the visual appeal but had numerous drawbacks. In recent times, zirconia crowns, commonly referred to as "ceramic steel," have been developed. These crowns offer satisfactory aesthetics and impressive mechanical characteristics, making them suitable for restoring both permanent and primary teeth. [3] The dental implants are designed with anatomical contours, devoid of any metal components,

biologically inert, white in color, and highly resistant to dental decay. [4]

SSCs were initially introduced into the field of juvenile dentistry by Rocky Mountain Company in 1947. They were first described by Engel and later popularized by Humphrey in 1950. For the last 70 years, SSCs have been used on primary and permanent molars to repair teeth with multiple surface cavities, in patients who have a high risk of cavities, after pulp therapy, and to repair teeth with developmental anomalies and teeth that are weak and likely to break. SSCs have demonstrated superior durability and longevity compared to materials such as amalgam and composite for over 50 years. Until now, no restorative material has been able to provide the benefits of being inexpensive, long-lasting, and dependable when temporary full-coronal coverage is needed. [5,6] Despite the advantages, the significant drawback of the SSC is its aesthetics, since the metallic appearance has been unfavorably perceived by patients, parents, and practitioners. [5] The growing parental demand for aesthetic restorations prompted the development of veneered stainless steel crowns (SSC). The crowns were composed of a resin or ceramic front that was bonded to the metal SSC. While parents generally approved of the aesthetics, these crowns had disadvantages including their large size, negative impact on gum health, and the potential for the veneer to break, resulting in an unattractive appearance. [7] Therefore, practitioners sought a crown that would possess both the endurance and lifespan of the SSC while also being aesthetically beautiful.

Zirconia crowns have been utilized for more than twenty years in permanent dentition, and they have gained significant popularity due to their pleasing appearance, strong compatibility with the body, and exceptional mechanical characteristics. In 2008, EZ Pedo (now known as EZ crown by Sprig) launched the initial pediatric zirconia crown that was available for purchase. Subsequently, multiple businesses have introduced zirconia crowns as a novel form of full-coverage restoration that offers both exceptional aesthetics and good mechanical characteristics. [8] Despite the growing expectations from parents, a recent literature analysis found no published trials that demonstrate the clinical effectiveness and parental approval of zirconia crowns in primary molars. [9] The objective of this study was to assess and compare the clinical efficacy, level of satisfaction among parents for using stainless steel and zirconia crowns for primary molars.

Materials and Methods

Table 1: Comparison of parental satisfaction of group I (SSC) and group II (zirconia) at 6 months, 12 months, 18 months, 24 months, and 36 months

This prospective randomized controlled trial was designed as a split-mouth study. which exfoliation was imminent, tooth with internal resorption, and tooth with acute infection at Mithila Minority Dental College and Hospital, Darbhanga, Bihar, India.

The patients with bilateral pulp therapy treated teeth were randomly divided into two groups by coin toss in which group I consisted of 50 primary second molars which would receive SSC (3M ESPE, Minneapolis, USA) and group II consisted of 50 primary second molars which would receive zirconia crowns (Kinder Krown, Minneapolis USA).

The pulp therapy treated teeth considered for study were radiographed preoperatively and only those which fulfilled the selection criteria were included in the study. All crowns were placed by a single operator and a new set of burs were used for each crown. The crown selection was determined by a coin toss.

Local anesthesia was administered and a rubber dam was placed. The manufacturer's guidelines were followed to develop a step by step customized tooth preparation to ensure all crowns were fitted in a similar manner. All crowns were luted using type I Glass Ionomer Cement (GC Corp, Japan). The type and size of crown chosen as well any adaption methods done for each molar were recorded. Patients were given postoperative instructions and scoring upon placement was completed. Participants were recalled for follow up at 6 months, 12 months, 18 months, 24 months, and 36 months. Variables for the clinical outcome were scored using a customized scoring table which was modified from similar previous studies. [10,11]

Parental satisfaction was assessed on a Likert type scale from 1 to 5 using the seven following variables: shade, size, shape, retention, durability, overall satisfaction, and child's satisfaction. The questionnaire was administered to the parent in the absence of the dentist by the receptionist. Parents were asked to return the questionnaire on completion to the receptionist. Scores 1 and 2 were combined as satisfied, score 3 as neutral response and scores 4 and 5 were combined as dissatisfied. Scoring of clinical success, parental and child satisfaction were taken at 6 months, 12 months, 18 months, 24 months, and 36 months. The values obtained were subjected to statistical analysis with one way ANOVA and Post Hoc T-tests using SPSS version 21.0 (SPSS Inc. Chicago, Illinois, USA).

Results

Clinical success (in %)	Group 1					Group 2				
	6 m	12 m	18 m	24 m	36 m	6 m	12 m	18 m	24 m	36 m
Crown retention	100	100	100	100	100	100	100	100	100	100
Modified gingival index	100	100	100	100	100	100	100	100	100	100
Plaque index	100	82	84	88	100	100	100	100	100	100
Stain resistance	100	100	100	100	100	100	100	100	100	100
Gingival Marginal extension	100	100	100	100	100	100	100	100	100	100
Occlusion	100	100	100	100	100	100	100	100	100	100
Proximal contact	100	100	100	100	100	100	100	100	100	100

The clinical success of both SSC and zirconia crowns was 100% (criteria scoring = 0) throughout the study period in terms of crown retention, modified gingival index, stain resistance, gingival marginal extension, occlusion, and proximal contact at placement. Both crowns varied only in plaque index.

Table 2: Comparison of parental satisfaction of group I (SSC) and group II (zirconia) at 6 months, 12 months, 18 months, 24 months, and 36 months

Parental satisfaction (in %)	GROUP 1					GROUP 2				
	6 m	12 m	18 m	24 m	36 m	6 m	12 m	18 m	24 m	36 m
Color	42	44	42	44	42	100	100	100	100	100
Shape	100	100	100	100	100	100	100	100	100	100
Size	100	100	100	100	100	100	100	100	100	100
Retention	100	100	100	100	100	100	100	100	100	100
Durability	100	100	100	100	100	100	100	100	100	100
Overall satisfaction	100	100	100	100	100	100	100	100	100	100
Childs satisfaction	54	56	54	56	56	100	100	100	100	100

Parental satisfaction for both groups was equal in terms of shape, size, retention, durability, and overall satisfaction. Only 21 parents (42%) were satisfied with the color of SSC, whereas 50 parents (100%) were satisfied with the color of zirconia. A significant statistical difference ($P < 0.001$) was seen between the groups. The parental view did not change during the study period. All 50 patients (100%) were satisfied with the zirconia crowns, while only 27 of the patients (54%) were satisfied with SSC. A significant statistical difference ($P < 0.001$) was present between both groups.

Discussion

Early childhood caries is a highly destructive and widespread condition in children that specifically affects their primary teeth. It can lead to difficulties in speech, chewing, maintaining proper arch length, and physical appearance. Pediatric dentistry is essential for the dental development of young patients as it focuses on restoring and maintaining the health of their primary teeth until the permanent teeth emerge in the mouth. Due to the persistent challenge of treating severe cavities in primary and young permanent teeth, stainless-steel crowns have emerged as a crucial solution for restoring significantly decayed teeth. [12] Stainless steel crowns (SSCs) offer long-lasting and dependable

full coverage restorations that remain in place for the entire lifespan of a primary tooth. [13] The stainless-steel crown has been demonstrated to be the preferred repair option, sometimes referred to as the "gold standard." The purpose of this dental procedure is to prevent tooth fractures by providing full coronal coverage and reducing the risk of leaking. Additionally, it creates a biological seal. [14]

Notwithstanding these disparities, both groups exhibited equivalent crown retention. The retention of zirconia in Kinder Crowns crowns is attributed to the presence of internal retention threads. These threads enhance the surface area available for cementation, compensating for the increased amount of tooth reduction. In a study conducted by Seminaro et al [15], the survival rate of zirconia on primary incisors following a 36-month follow-up for children who had anesthesia was reported to be 76%. However, our study observed a higher survival rate compared to their findings. Both SSC and zirconia crowns achieved a clinical success rate of 100% (criteria score = 0) in terms of crown retention, modified gingival index, stain resistance, gingival marginal extension, occlusion, and proximal contact at placement, during the whole trial period. The only difference between the two crowns was in the plaque index. The dissimilarity between SSC and zirconia

can be ascribed to the imperfections of polymeric surfaces of SSC that facilitate bacterial adherence and biofilm deposition, [16,17] whereas the very smooth and polished surface of zirconia does not encourage bacterial adhesion and biofilm deposition. [18] Repeated manipulation of the SSC by means of cutting and crimping likely resulted in surface imperfections. The variation within the SSC group can be ascribed to the individual oral hygiene practices of each patient. [17]

The level of parental satisfaction was equivalent for both groups in terms of shape, size, retention, durability, and overall satisfaction. Out of the total number of parents surveyed, only 21 (42%) expressed satisfaction with the color of SSC, while all 50 parents (100%) were delighted with the color of zirconia. A statistically significant difference ($P < 0.001$) was observed between the groups. There was no change in the parental perspective over the duration of the investigation. All 50 patients, representing 100% of the sample, expressed satisfaction with the zirconia crowns, whereas only 27 patients, accounting for 54% of the sample, reported satisfaction with SSC. A statistically significant difference ($P < 0.001$) was observed between both groups. Both SSC and zirconia crowns exhibited resistance to staining. Micro porosities are the primary cause of stains on a recently placed repair. [19] Parents exert significant influence in decision-making, a responsibility that was formerly solely held by the dentist's individual judgment. The process of clinical decision-making now encompasses a social dynamic involving the dentist, patient, parents, and sometimes other family members. When offering treatment alternatives, dentists should take into account the attitudes, beliefs, and values of parents about esthetics and function. Given the potential differences in viewpoints between dentists and parents regarding the best treatment, it is important to recognize these variations in order to enhance communication and develop a treatment plan that takes into account the concerns and preferences of parents. [20,21]

Conclusion

Stainless steel crowns continue to be considered the "Gold Standard" for fully covering the back teeth in primary molars. This is because they have a simpler crown preparation process and are less expensive compared to zirconia crowns. Zirconia crowns, despite their esthetic appeal, require a highly invasive crown preparation procedure and cannot be administered without local anesthesia. Additionally, they are time-consuming, which leads to lower acceptance rates among parents and patients.

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