

# Survey on the Use of Zirconia Crowns in Pediatric Population among General Dental Practitioners

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## Abstract

**Background** Pediatric zirconia crowns are metal free and more aesthetic and compatible option available for the full coronal coverage of the affected primary dentition. These crowns are not new to pediatric dentistry but usage is limited.

**Materials and Methods** A cross-sectional, descriptive survey was conducted among 200 general dental practitioners and were requested to answer a questionnaire. The questions were framed regarding the knowledge of pediatric dental procedures, aesthetic replacement in case of full coverage restorations, and zirconia crown's features and its use in the practice, and were evaluated.

**Results** Results were based on features of zirconia crowns according to which 81.5% participants mentioned them as stainless steel alternative and 62% as biocompatible material. Clinical aspects evaluated the amount of occlusal reduction in case of zirconia crown tooth preparation as 1 to 1.5 mm by 72.5% of the participants. Appropriate type of finish line and type of margins advocated by the participants was chamfer and subgingival finish line, respectively, according 62.0% participants.

**Conclusion** The use of zirconia crowns for replacement of lost tooth structure and post-pulp therapy helps in creating good-looking restorations which help children and adolescents to improve their self-image.

## Keywords

- ▶ pediatric zirconia crowns
- ▶ general dental practitioners
- ▶ full coverage restorations

## Introduction

Dental aesthetics is synonymous with facial aesthetics. In this respect, placement of crowns on severely decayed teeth and post-pulp therapy provide better functional replacement to natural crown portion of the teeth and enhance aesthetics.<sup>1</sup> Stainless steel crowns (SSCs) were first used crowns, introduced by Engel and pursued by Dr. William Humphrey (1950). They provide protection to the residual tooth structure that may have been weakened after excessive

caries removal and have a low failure rate but compromise in providing aesthetic replacement.<sup>2</sup> As an advancement to this feature many crowns were introduced but zirconium crowns had most advantages than limitations.<sup>2</sup>

## Materials and Methods

A cross-sectional, descriptive survey was conducted among general dental practitioners in and around Karnataka state.

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**Table 1** Gender wise distribution of study participants

Variable	Category	n	%
Gender	Males	97	48.5
	Females	103	51.5
	Total	200	100.0

**Table 3** Distribution of study participants based on their location of dental practice

Variable	Category	n	%
Location of dental practice	Urban	118	59.0
	Semiurban	62	31.0
	Rural	20	10.0
	Total	200	100.0

### Questionnaire

A convenience sample of 200 practitioners had participated in the survey with a questionnaire of a total of 17 questions. The questions were framed regarding the knowledge about pediatric dental procedures performed, zirconia crown's features, and its use in their regular practice. All answers were treated with utmost confidentiality. Data was collected and subjected to statistical analysis, and the results were expressed as absolute values and percentages.

**Sample and data handling:** The estimation of sample size was done by the below formula

$$n = \frac{Z^2 pq}{f^2} = 200$$

where,  $Z = 1.96$

$$p = 0.39$$

$$q = 1 - p = 0.607$$

$$f = 18\% = 0.8$$

**Table 2** Distribution of study participants based on their years of practice

Variable	Category	n	%
Years of practice	< 5 y	90	45.0
	5–10 y	60	30.0
	> 10 y	50	25.0
	Total	200	100.0

Prior to conducting the study, ethical approval was taken from the institutional authorities. The questionnaire was given in the form of Google Forms to all the general dental practitioners through various online sources (WhatsApp, email, etc.) available.

**Statistical analysis:** Data from questionnaires received were entered in Statistical Package for Social Sciences for Windows (Version 22.0, released 2013; IBM Corp., Armonk, New York), and was used to perform statistical analyses. From this database, the overall response rate was calculated, together with the percentage responses for each question. Descriptive analysis included expression of responses to the study questionnaire in terms of frequency and proportions. Chi-square goodness-of-fit test was used to compare the distribution in the responses for the study questionnaire by the study participants. Chi-square test was used to compare the responses ▶ **Table 1** to the study questionnaire based on the qualification of the participants.

The level of significance was set at  $p < 0.05$ .

### Results

The results of our current survey has the following data.

**Demographics and characteristics:** Out of the 200 respondents ▶ **Table 1**, 97 (48.5%) were males and 103 (51.5%) were females. The demographics indicated almost equal number of male ▶ **Table 2** and female participants.

Based on the distribution of the participants on the period ▶ **Table 2** of practice 45% of the study population was recent to the clinical practice and ▶ **Table 3** 59 and 31% of the practitioners were urban and semiurban practitioners, respectively. This indicated that approximately half of the participants had knowledge of latest materials evolved in

**Table 4** Comparison of distribution of responses for the questions on pediatric dental practice among study participants using chi-square goodness-of-fit test

Questions	Responses	n	%	Chi-square value	p-Value
What are the approximate numbers of pediatric patients treated every week?	< 5 patients	60	30.0	59.080	< 0.001 <sup>a</sup>
	5–10 patients	114	57.0		
	> 10 patients	26	13.0		
What are the common treatment procedures performed in your practice in case of deep dental caries in primary dentition?	Restorations	28	14.0	189.160	< 0.001 <sup>a</sup>
	Pulp therapy	158	79.0		
	Extractions	14	7.0		

<sup>a</sup>Statistically Significant.

**Table 5** Comparison of distribution of responses for the questions related to crown procedures in pediatric dental practice among study participants using chi-square goodness-of-fit test

Questions	Responses	n	%	Chi-square value	p-Value
Are patients opting for crown procedures in your practice?	Yes	175	87.5	112.500	< 0.001 <sup>a</sup>
	No	25	12.5		
Do you prefer pediatric crowns as a postoperative treatment procedure in case of?	Multisurface tooth restorations	11	5.5	101.410	< 0.001 <sup>a</sup>
	Pulp therapy	62	31.0		
	Both	127	63.5		
Crowns preferably advised by you for treating deciduous anterior teeth?	Strip crowns	104	52.0	36.430	< 0.001 <sup>a</sup>
	Pedo Jacket crowns	61	30.5		
	Zirconia crowns	35	17.5		
Crowns preferably advised in case of deciduous posterior teeth?	Stainless steel crowns	158	79.0	187.720	< 0.001 <sup>a</sup>
	Zirconia crowns	20	10.0		
	Custom fabricated metal crowns	22	11.0		

<sup>a</sup>Statistically Significant.

dentistry. Due to the impact of urban dental practice the expectancy of the patients regarding the aesthetic treatment was more in urban than in semiurban practitioners.

As shown in ►Table 5, approximately 5 to 10 pediatric patients are regularly treated in general dental practice every week based on the results of 57% of the general dental practitioners. This determines that parents are more concerned about the dental treatment of their children and always prioritize their treatment in the present days. The results also suggested that 79% of the general dental practitioners advised pulp therapy and parent were also interested in advocating the concept of preservation of the primary teeth over extraction in pediatric patients.

As shown in ►Table 5, approximately 87% of the parents accepted and were willing to go ahead with postoperative crown whenever suggested by their dentist. This shows that

parents were concerned advocating the procedure advised by the dentist about the long-term prognosis of the treatment and importance of retaining the primary dentition as functional rehabilitation and aesthetic maintenance and space maintenance. About 79% of the general dentist advocated SSCs as it was the regularly used crowns.

As shown in ►Table 6, based on what features would you prefer zirconia crowns, 81% of the dentists used them as a stainless steel alternative, 14% used them as stainless steel alternative and only 4% used them due to cost factor based on the features of biocompatibility and esthetics zirconia crowns can be advocated as better. These crowns were advocated by the general dentist as biocompatible material by approximately 62% of dentists and 46% used the prefabricated form.

As shown in ►Table 7, most of the dentists had adequate knowledge regarding the clinical aspects of the crown

**Table 6** Comparison of distribution of responses for the questions related to awareness of zirconia crowns in pediatric dental practice among study participants using chi-square goodness-of-fit test

Questions	Responses	N	%	Chi-square value	p-Value
Based on what features would you prefer zirconia crowns?	Stainless steel alternative	29	14.5	212.110	< 0.001 <sup>a</sup>
	Esthetic enhancement	163	81.5		
	Cost factor	8	4.0		
Based on what factors would you prefer zirconia crowns?	Biocompatibility	124	62.0	85.960	< 0.001 <sup>a</sup>
	Fracture resistance	58	29.0		
	Metal allergy	18	9.0		
In case of zirconia crowns selection do you prefer?	Prefabricated	92	46.0	18.760	< 0.001 <sup>a</sup>
	Custom fabricated	42	21.0		
	Both	66	33.0		
Have you used any of the prefabricated zirconia crowns?	EZ Pedo	47	23.5	85.210	< 0.001 <sup>a</sup>
	Nu Smiles	127	63.5		
	Kinder Krowns	26	13.0		

<sup>a</sup>Statistically Significant.

**Table 7** Comparison of distribution of responses for the questions related to Awareness on clinical aspects of using zirconia crowns among study participants using chi-square goodness-of-fit test

Questions	Responses	n	%	Chi-square value	p-Value
What is the amount of occlusal reduction in case of zirconia crown tooth preparation?	0.5–1 mm	31	15.5	138.430	< 0.001 <sup>a</sup>
	1–1.5 mm	145	72.5		
	1.5–2 mm	24	12.0		
What is the appropriate type of finish line in zirconia crown tooth preparation?	Shoulder	30	15.0	102.280	< 0.001 <sup>a</sup>
	Chamfer	134	67.0		
	Knife edge	36	18.0		
What types of margins are advocated in zirconia crown tooth preparation?	Supra gingival	29	14.5	76.390	< 0.001 <sup>a</sup>
	Gingival	47	23.5		
	Subgingival	124	62.0		

<sup>a</sup>Statistically Significant.

adaptation as 72.5% used 1 to 1.5 mm of occlusal reduction, 67% advocated chamfer finish line, and 62% advocated subgingival finish line.

## Discussion

The present study analyzed data from a sample of 200 general dental practitioners in and around Karnataka to assess knowledge and practice methods regarding pediatric dental patients in their general dental practice. The general practitioners form a major section of dental practitioners in the urban and rural population, and their knowledge and awareness concerning rehabilitation of primary teeth is a major uncharted area. The endodontic management of primary teeth does provide symptomatic relief and masticatory rehabilitation to the patient, but does not promise long-term prognosis. The principle and necessity of full coverage restorations in postendodontic treatment in primary teeth is still lagging in the mindset of practitioners. General dentists with a minimum practice period of 5 years took part in the study, in which 51.5% participants were females and 48.5% males. The results provided valuable information regarding the number of pediatric dental patients in general dental practice, dental procedures routinely performed on pediatric patients, and use of advanced aesthetic replacement for lost tooth structures with the use of zirconia crowns is considerably new in the field of pediatric dentistry.

SSCs have been used to restore deciduous and permanent posterior teeth for practically 50 years. The SSC crowns are long-lasting enough to withstand occlusal forces, require minimal technique, sensitive during adaptation, comparatively reasonable, and offer the advantage of full coronal coverage.<sup>3</sup> Even with these favorable qualities, SSCs have a major downside, that is, their poor aesthetic appearance and hence limited use in the anterior segment.<sup>2</sup>

Crowns made of zirconia contain no metal. Zirconia is currently the toughest dental ceramic available and is also aesthetically acceptable. Latest research on passive fit prefabricated zirconia crowns for primary anterior teeth is restricted.

Based on the results of our survey with regard to procedure practices in relation to the common treatment procedures performed in their practice in case of deep dental caries in primary dentition, 79.0% opted for pulp therapy as a treatment option. Based on the opinions of patients regarding crown fabrication after pulp therapy as option, 87.5% of the parents or guardians were willing for the pulp therapy and crown placement and only 12.5% did not want the crown procedure to be followed by pulp therapy. Concern of parent or guardians for post-pulp therapy with the placement of crowns was well established according to the results of our study.

Dimitrov et al summarized the following indications for preformed crowns usage on primary teeth prior to pulp therapy as for restorations of multisurface caries and for patients at high caries risk, primary teeth with developmental defects, fractured teeth, teeth with extensive wear, and abutment for space maintainer.<sup>4</sup>

In regard to anterior teeth restoration and rehabilitation, the general dental practitioners (52.0%) opted for strip crowns followed by 30.5% Pedo Jacket crowns and 17.5% only opted for zirconia crowns which shows the limited usage of these crowns. In regard to posterior teeth restoration and rehabilitation either SSCs (79.0%), zirconia crowns (10.0%), or custom fabricated metal crowns (11.0%) were used.

Awareness of zirconia crowns in pediatric dental practice evaluated based on features of zirconia crowns, participants' responses were as follows 14.5% recommended zirconia crowns as stainless steel alternative, 81.5% recommended as an aesthetic enhancement, and 4.0% only advised them because of cost factor. On factors to prefer zirconia crowns, biocompatibility was 62.0%, fracture resistance was 29.0%, and metal allergy was up to 9.0%. In case of zirconia crowns selection prefabricated was preferred among 46.0%, custom fabricated by 21.0%, and both by 33.0% participants.

Tote et al summarized the following features of prefabricated zirconia crowns referred in our current study. The zirconium crowns are polycrystalline ceramic without glass component. It is a polymorph that occurs in three forms,

namely, monoclinic, pure zirconia stable at 1,107°C; tetragonal, above 1,107°C; and cubic form, at 2,370°C.

The volume expansion caused by different forms of zirconia induces large stress which leads zirconia to crack. By adding small amount of yttria these phase changes are eliminated and the resulting material has high compressive strength, high fracture resistance, corrosion resistance, durability, and biocompatibility.<sup>5</sup> These metal-free crowns are available in different types based on the manufacturer. Few crowns are made up of high-grade monolith zirconium ceramic with increased durability and strength. Translucency of zirconium ceramic offers tremendous esthetics and prevents the problem of dark tooth show through pulpally treated teeth. They are also provided with try-in crown to check fitting prior to final cementation. This feature not only saves clinician's chairside time but also eliminates extra steps and disinfection of the crown.

Some crowns are based on nanotechnology producing most consistent, high-quality zirconia that are polished to reduce opposite enamel wear. They also have internal retention system which locks the restoration after cementation. These retention bands also provide with additional surface for bonding. Fine feathered margin of zirconia crowns are also available that makes the emergence profile for the crown as natural as possible. Another type of zirconia crowns has extra retention technology, that is, retentive grooves which extend all the way to the crown margins, preventing cement washout. They also prevent entry of harmful bacteria, additional retention is provided through blasting with aluminum oxide.

Advantages of zirconia crowns are high strength and toughness, can withstand wear and tear, translucent enough to be comparable to natural teeth, less tooth removal, no metal fuse modifiable size, shape, and color, biocompatible, and autoclavable. The only disadvantage is abrasive effect on tooth.<sup>6</sup>

In vitro study was done by Townsend et al to measure the fracture resistance of three commercially existing zirconia crowns for primary molar and compared it with the thickness of the zirconia crowns and measured fracture resistance of veneered SSCs. It was found that the increase in force is correlated with crown thickness. The forces essential to fracture the veneered SSCs were greater than the forces required to fracture all the commercially available zirconia crowns. The main positive feature of zirconia crowns was its aesthetic resemblance to the natural teeth and also possessed adequate fracture resistance in regard to primary dentition.<sup>7</sup>

Awareness on clinical aspects of using zirconia crowns among the participants were evaluated with the following results where the amount of occlusal reduction in case of zirconia crown tooth preparation was thought as 0.5 to 1 mm by 15.5%, 1 to 1.5 mm by 72.5%, and 1.5 to 2 mm by 12.0% of the participants. Appropriate type of finish line in zirconia crown tooth preparation had the following knowledge and the type advocated by the participants were shoulder by 15.0%, chamfer 67.0%, and knife edge 67.0% participants. Types of margins advocated in zirconia crown tooth prepara-

tion with these results are supra gingival 14.5%, gingival 23.5%, and subgingival 62.0%.

Ideal tooth preparation in the use of zirconium crowns was limited so implementing the following would enhance the usage of zirconium crowns in pediatric dental patients.

Tooth preparation and cementation procedure are important clinical steps in crown placement. The presence of adequate clearance, proper angulations, and visible knife-edge finish lines help to preserve gingival health and less plaque accumulation. Sufficient preparation of the tooth will considerably improve aesthetics, crown fit reduces chances of veneer fracture, and saves chair time. The tooth should be prepared to fit the crown so that the crown fits the tooth passively without using pressure.<sup>8</sup>

Crown preparation for anterior teeth in primary teeth involves selection of appropriate size of crown measuring the mesiodistal width. Incisal reduction of 1.5 to 2 mm incisally using donut-shape bur following the incisal plane and supra-gingival reduction includes a chamfer finish line of 0.5 to 1 mm on all four sides of the crown equigingival using chamfer bur. Using a taper bur, removal of the chamfer finish line going 1 to 2 mm subgingival making a feather edge or no finish line is the appropriate technique.

In case of posterior teeth appropriate crown size was evaluated prior to the tooth preparation by holding a crown up to their existing tooth or considered the mesiodistal dimension and determined the crown size to be used established on the original size of the tooth. On the other hand, a digital X-ray system may help presize the crown by obtaining measurements in the software and match patient's interproximal width to the corresponding crown size. The crown preparation and adaptation procedure include occlusal preparation using the marginal ridge of the adjacent teeth as a reference point, 1.5 to 2 mm of occlusal reduction was completed. Buccal-lingual reduction is also recommended which includes approximately 1 to 1.5 mm using a flame-shaped diamond bur and the bur parallel to the tooth. Keeping the bur parallel to the tooth ensures consistent reduction from the occlusal down extended up to the gingival tissue. The interproximal reduction involves 1 mm using a flame-shaped diamond bur, such as a 0.368 or 0.330 tapered carbide. During interproximal reduction, the bur is placed parallel to the tooth and supra-gingival. Using a flame-shaped diamond bur subgingival reduction is done approximately 1 to 2 mm, ending with a feathered margin. Frequently, there is a residual band of tooth structure, just below the tissue—removing that tooth structure is significant to achieve a passive fit. The most significant element when placing zirconia crown is that a passive fit is mandatory. The properly sized crown will seat passively and subgingivally 1 to 2 mm and should not alter the gingival tissue.<sup>9</sup>

Prakash and Raju conducted a systemic review to investigate the failure and the reasons for failure of pediatric crowns. It was concluded that composite strip crowns have lower success rate and higher gingival inflammation. Veneered SSCs can have facial veneer fracture. Prefabricated zirconia crowns are retentive and also gingiva compatible.<sup>10</sup>

Ajayakumar et al conducted a systemic review on use of restorative full crowns made with zirconia in children. The study was a meta-analysis, it used a PICOS framework. Zirconia crowns have been proved to provide better results than other crowns in terms of gingival and periodontal health, esthetics, and crown fractures.<sup>11</sup>

## Conclusion

The use of zirconia crowns for replacement of lost tooth structure and post-pulp therapy helps in creating good-looking restorations which help children and adolescents to improve their self-image.

### Ethical Approval

Ethical approval was taken from the institutional authorities.

### Funding

The study was self-funded.

### Conflict of Interest

None declared.

## References

- 1 Mittal Kumar G, Verma A, Pahuja H, Agarwal S, Tomar H. Esthetic crowns in paediatric dentistry: a review. *Int J Contemp Med Res* 2016;3(05):1280–1282
- 2 Garg V, Panda A, Shah J, Panchal P. Crowns in paediatric dentistry: a review. *J Adv Med Dent Sci Res* 2016;4(02):41–46
- 3 Sajjanshetty S, Patil P, Hugar D, Rajkumar K. Pediatric preformed metal crowns-an update. *J Dent Allied Sci* 2013;2:29
- 4 Dimitrov E, Georgieva M, Andreeva R. Indications for use of performed crowns in pediatric dentistry. *Med Inform (Lond)* 2016;2:439–445
- 5 Ram D, Fuks AB, Eidelman E. Long-term clinical performance of esthetic primary molar crowns. *Pediatr Dent* 2003;25(06):582–584
- 6 Tote JV, Godhane A, Das G, Soni S, Jaiswal K, Vidhale G. Posterior esthetic crowns in pediatric dentistry. *Int J Dent Med Res* 2015;1(06):197–201
- 7 Townsend JA, Knoell P, Yu Q, et al. In vitro fracture resistance of three commercially available zirconia crowns for primary molars. *Pediatr Dent* 2014;36(05):125–129
- 8 Khatri A. Esthetic zirconia crown in pedodontics. *Int J Pedodontic Rehabil* 2017;2(01):31
- 9 Marwah N. *Textbook of Pediatric Dentistry*. JP Medical Ltd; 2018
- 10 Prakash AS, Raju VG. Crowns in paediatric dentistry—a review on the failures. *Oral Health* 2020;5:1–4
- 11 Ajayakumar LP, Chowdhary N, Reddy VR, Chowdhary R. Use of restorative full crowns made with zirconia in children: a systematic review. *Int J Clin Pediatr Dent* 2020;13(05):551–558