

# Applicability of Zirconia-Prefabricated Crowns in Children with Primary Dentition

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*Zirconia dioxide represents the current alternative in restoring primary teeth, being the most promising restorative material through its properties that offer. Zirconia crowns main properties are its aesthetics, resistance to fracture and compression, biocompatibility, alternative for the patients that are allergic to Ni-Cr. This cross-sectional study pointed out the correlations between the rate of applicability of the Ni-Cr crowns and the ZrO<sub>2</sub> crowns, as well as the range of applicability of the ZrO<sub>2</sub> crowns on temporary teeth among practitioners. The method of choice in the case of extensive carious lesions treatment on the primary teeth was the restoration using filling materials. From the 33,2% of the dentists who decide to apply a pedodontics crown, 75% use the Ni-Cr crowns, and only 25% of them choose the ZrO<sub>2</sub> crown ( $p < 0.0001$ ). The applicability of ZrO<sub>2</sub> crowns in pediatric dentistry is quite reduced, despite their physiognomic advantages, their excessive cost can also be an impediment for the patient's parents.*

**Keywords:** prefabricated crowns, zirconia dioxide, dental restoration

Prefabricated metal crowns, having in their composition nickel and chromium, represent the most frequent way of restoring traumatized temporary teeth or with carious lesions. Because of their significant aesthetic disadvantage, the actual trends in pedodontics restoration is represented by the introduction of prefabricated zirconia crowns [1, 2].

Zirconia is a class silicate mineral, precisely from the inosilicates group, with its chemical formula  $ZrSiO_4$  and its hardness 6.5-7.5 on Mohs scale. It can be found in the form of a mineral that contains 80-90%  $ZrO_2$  and traces of  $TiO_2$ ,  $SiO_2$ ,  $Fe_2O_3$ . Based on the temperature,  $ZrO_2$  is found in three structures: monoclinic on the room's temperature, tetragonal at 1200°C, cubic at 2370°C. While cooling a transformation occurs from the tetragonal phase to the monoclinic phase, as well with a volumetric expansion that varies between 3-4% with the forming of cracks in the mineral. Partially stabilized Zirconia is the material besides pure Zirconia that contains calcium oxides, magnesium, yttrium, and cesium, added to stabilize the tetragonal phase and/or with the cubic phase and to enhance its resistance, hardness and density [3-5].

The natural color of zirconia varies between colorless, golden-yellow, red to brown, but it can also be green, blue and black. Pure zirconia examples are precious stone (diamonds) replacers that can easily be confused.

Prefabricated zirconia crowns, recently launched in the American pediatric dentistry market, are used as a physiognomic alternative in restoring primary compromised teeth from extensive carious lesions. Therefore Zirconia dioxide  $ZrO_2$  (zirconia) represents the alternative in restoring primary teeth, being the most promising restorative material through its mechanical and physiognomic properties that offer [6]. In the last period, there have been more manufacturers of zirconia crowns on the market such as EZ Pedo (EZ), NuSmile (NSZ), KinderKrown (KK).

Zirconia crowns main properties are its aesthetics; resistance to fracture and compression; biocompatibility; it requires only one visit for the insertion of the restoration; relatively small sacrifice in dental tissue; an alternative for the patients that are allergic to Ni-Cr; autoclavable. Disadvantages: they can't be modified, and the tooth practically will be adjusted to the crown; they are thicker than the prefabricated metallic crowns – thus the preparation is more aggressive, and the risk of opening the pulp is greater; it needs to be replaced in case of a fracture; high cost [6-8].

The primary cause of the zirconia crowns deterioration is due by the loss of internal retention, not by fracture. The interior of the EZ Pedo crown is designed with a retentive concept, solving its loosening problem (fig. 1).

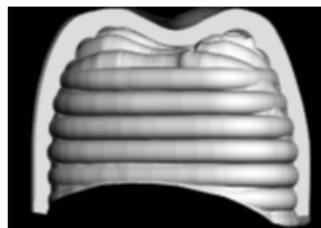


Fig. 1. Ez Pedo crown retention [9]

The indications for the zirconia crowns are same as for the prefabricated metallic crown Ni-Cr, but because they are new on the market and have high costs, they are rarely used. We proposed to evaluate the range of applicability of the zirconia compared to the metallic crowns, amongst dentists and specialized students.

## Experimental part

### Material and methods

This cross-sectional study pointed out the correlations between the rate of applicability of the Ni-Cr crowns and the  $ZrO_2$  crowns, as well as the range of applicability of the

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ZrO<sub>2</sub> crowns on temporary teeth amongst practitioners. The survey was based on creating and analyzing several targeted forms, containing questions regarding the applicability of the Ni-Cr, as well as ZrO<sub>2</sub> crowns, that were delivered to dentists and students. The forms were distributed to dentists from Targu Mures, Timi<sup>o</sup>oara and students for the 5<sup>th</sup> and 6<sup>th</sup> year from the following universities: Targu Mures, Timi<sup>o</sup>oara, and Ia<sup>i</sup>. We designed two sets of forms that were sent to the dentists and students. The forms were delivered through the College of dentists.

*The form delivered to the dentists:*

- Do you perform pedodontics treatments in your current practice?

- In what area do you practice dentistry?

- What type of treatment do you prefer in case of extensive carious lesions on primary teeth?

- Do you choose to apply pedodontics crowns in case the restorative treatment fails?

- Do you apply the Ni-Cr crown or the ZrO<sub>2</sub> crown?

*The form delivered to the students:*

- Do you perform pedodontics treatments in summer practice or at the university?

- What type of therapy do you prefer in case of extensive carious lesions on primary teeth?

- Do you choose to apply pedodontics crowns in case the restorative treatment fails?

- Do you apply the Ni-Cr crown or the ZrO<sub>2</sub> crown?

The data processing was done with the help of the GraphPadPrism 5.0 soft using Spearman's correlation test, the threshold of statistical signification was set at the value of p<0.05 at a confidence interval (CI) of 95%.

**Results and discussions**

We received a total of 311 answers (fig. 2): 194 answers from the dentists in Targu Mures and Timisoara; 59 answers from the students in Iasi and Timisoara; 58 answers from

the students in universities like Iasi and Timisoara. We noticed the high interest in doctors in completing the form.

Regarding the answers from the dentists:

- 86% of them practice in the urban area;

-67.4% perform pedodontics treatments and 27.7% on occasion, and just 4.9% don't perform any pedodontics treatments;

-10.9% prefer using the pedodontics crown as a restorative way of restoring primary teeth;

-33.2% frequently use pedodontics crowns, and only 25% of them apply ZrO<sub>2</sub>, the rest of 75% apply Ni-Cr crown.

Regarding the answers gathered from the students in Targu Mures:

-37.3% performed pedodontics treatments in the specialized practices;

-The fillings with glass ionomer or with resins are the most used way of restoration;

-18.6% indicated the use of pedodontics crown as a restorative way in treating temporary teeth;

-38.8% choose the ZrO<sub>2</sub> crown, and 61.2% the Ni-Cr crown.

Regarding the answers gathered from the students in Timisoara and Iasi:

-41.4% don't perform pedodontics treatments;

-The fillings with glass ionomer or with resins are the most used way of restoration (55.2%); 32.8% take in consideration using Ni-Cr or ZrO<sub>2</sub> crowns;

-75.9% indicated the use of pedodontics crown as a restorative way in treating temporary teeth;

-25.4% choose the ZrO<sub>2</sub> crown, and 74.5% the Ni-Cr crown.

The results gathered from applying the Spearman correlation test are presented in the tables 1,2,3.

The method of choice in the case of extensive carious lesions treatment on the primary teeth was the restoration using filling materials: 82% of the practitioners (p<0.0001). The next preferred method was applying pedodontics

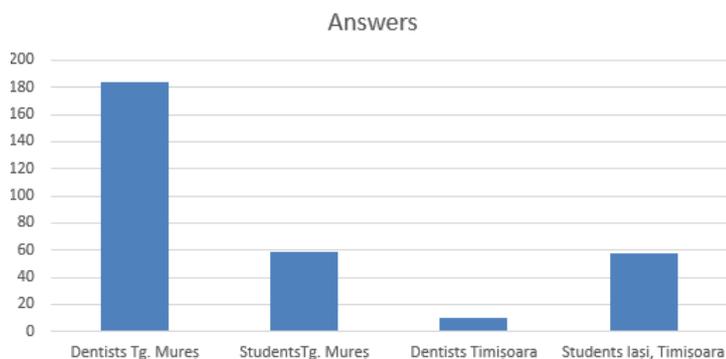


Fig. 2. Distribution of filled forms

**Table 1**

THE RESULTS OF THE CORRELATION TEST REGARDING THE TREATMENT SUSTAINED IN CASE OF EXTENSIVE CARIOUS LESIONS ON PRIMARY TEETH WITHIN THE STUDENT BATCH.

Parameters	Dental extraction	Dental restoration materials	ZrO <sub>2</sub> and Ni-Cr preformed crowns
Number of pairs	117	117	117
Spearman r	-0.1733	-0.8330	0.3166
95% confidence interval	-0.3488 to 0.01396	-0.8825 to -0.7653	0.1379 to 0.4753
P value	0.0617	< 0.0001	0.0005

Parameters	ZrO <sub>2</sub>	Ni-Cr	Do not use preformed crowns
Number of pairs	117	117	117
Spearman r	-0,1283	0,2549	-0,2123
95% confidence interval	-0.3078 to 0.05993	0.07151 to 0.4217	-0.3839 to -0.02650
P value	p=0.1679	0.0055	0.0216

**Table 2**  
THE RESULTS OF THE CORRELATION TEST REGARDING THE USE OF PEDODONTICS CROWNS ON THE STUDENT BATCH

Parameters	No dental treatment in children	ZrO <sub>2</sub> or Ni-Cr preformed crowns
Number of pairs	194	194
Spearman r	-0.3983	-0.3149
95% confidence interval	-0.5140 to -0.2685	-0.4401 to -0.1776
P value	< 0.0001	< 0.0001

**Table3**  
THE RESULTS OF THE CORRELATION TEST OBTAINED WITHIN THE DENTIST'S GROUP

crowns: 10.9% of the dentists ( $p < 0.0001$ ), the rest of 4,3% ( $p < 0.7731$ ) preferred not to use any treatment, and 2.7% of them chose extraction as a method of treatment ( $p < 0.4366$ ).

From the 33.2% of the dentists who decide to apply a pedodontics crown, 75% use the Ni-Cr crowns, and only 25% of them choose the ZrO<sub>2</sub> crown ( $p < 0.0001$ ). In the case of applying ZrO<sub>2</sub>, the study conducted by Twonsted indicates the use of the Ez Pedo Crown [10].

Students from Târgu Mureş perform a lot more pedodontics treatments in their summer practices as well as their practices in the universities than the students from the other two universities. The student threshold from Târgu Mureş that prefer using restoration materials is higher than the students from the other universities. Another notable difference was the great tendency in applying zirconia crowns in Tîrgu Mures than the low rate of applicability in the universities from Timisoara and Iasi.

The significant difference between dentists and students was pointed out when applying pedodontics crowns: more than 60% of the doctors preferred not using pedodontics crowns in case the treatment with filling material fails, however regarding the students, over 70% chose to apply pedodontics crowns. The applicability of the zirconia crowns was relatively low amongst doctors and students, most of them choosing the Ni-Cr in favor of the zirconia crowns.

A web-based cross-sectional survey, extremely recently [11] realized in Southern Arabia, identified situations where pedodontists apply physiognomic ZrO<sub>2</sub> crowns and metallic Ni-Cr, as well the preference of using restoration material on impacted primary teeth. From the 108 respondents, 86% use preformed metal crown Ni-Cr on the vital primary molars, after a pulpotomy. The zirconia crown is rarely utilized, 65% of the respondents do not account for the insertion of a ZrO<sub>2</sub> crown, not even on the anterior teeth where aesthetics comes first. These results are consistent with Riley's survey [12] that compared the decay identification risk and the therapeutically approach between experience practitioners and newly graduates.

Dos Santos [13] noticed a disparity regarding the recommendations of oral hygiene for children at the level of professional dental and pediatric organization from ten countries. Dentists are ethically bound to assure the dissemination of some actualized education materials of oral health [14], and the level of education and experience of dental practitioners are relevant for this survey's results [15, 16]. A national cross-sectional survey of general dental practitioners and pediatric dentists conducted in England [17], proved the high rate of applicability of preformed Ni-Cr crowns. The application options of Ni-Cr crowns on vital primary molar are of 49.1%, and regarding the treated endodontic molars, the rate of applicability amongst patients is 51.8%. The survey doesn't make any references to the aesthetic aspects, but in the posterior area aesthetics don't come first.

The results of our study are in correlation with the studies of Halawany, Kowolik and Wilson [11, 18, 19], pointing out the fact that ZrO<sub>2</sub> prefabricated crowns are insufficient utilized by practitioners, and the prefabricated Ni-Cr crowns are used on a larger scale by pediatric dentists compared to general dentists.

In another papers were studied some aspects of the dental zirconia surface properties [20, 21].

### Conclusions

The method of choice for treating extensive carious lesions on primary teeth is represented by the restoration with filling materials in detriment of applying prefabricated Ni-Cr or ZrO<sub>2</sub> crowns.

The applicability of Zr<sub>2</sub> crowns in pediatric dentistry is quite reduced, despite their physiognomic advantages, their excessive cost can also be an impediment for the patient's parents. Both dentists and students that were involved in the survey opted for using and applying prefabricated Ni-Cr crowns.

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