

## Survival of Glass Ionomer Restorations in Primary Molar Teeth in a Tertiary Hospital in Chitwan

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### Abstract

**Introduction:** Glass ionomer cement (GIC) is frequently used as a restorative material in dentistry and has been known for its anti-cariogenic property, biocompatibility and good marginal adaptation. The study aims to evaluate the survival of GIC restorations on primary molar teeth of dental patients attending College of Medical Sciences, Chitwan.

**Methods:** A retrospective longitudinal study was conducted among the patients who were treated with, at least one GIC restoration (GC Fuji II/GC Fuji IX GP) in their primary molars during the past three years. Data were collected to assess the demographic variables like gender, economic status and mother's education; restoration-related variables like no of surfaces involved, type of material used, location of the restoration in oral cavity, and age of restoration and; outcome related variable i.e. survival of restoration (survived / failed). United States Public Health Service (USPHS) criteria was used to determine survival. Data analysis was done using software SPSS version 17. Chi-square tests were carried out to find out the association between dependent and independent variables. Significance level was set at  $p < 0.05$ .

**Results:** The 1-3 years cumulative survival rate of the GIC restoration in primary molars was found to be 74.5%. The survival rates for 1 year, 2 years and 3 years were found to be 93.5%, 78.6% and 62.5% respectively. There was no significant association between the survival of the restoration and location of the tooth in oral cavity and sociodemographic indicators like gender, age, economic status and mother's education. However, statistically significant association was found between survival of restoration and type of restorative material, number of surfaces involved and age of restoration. Type VIII GIC had a higher survival rate (85.7%) compared to Type II GIC (68.2%), and single-surface restorations had a higher survival rate (84.9%) compared to two-surface restorations (52.3%).

**Conclusion:** Our findings suggest that GIC can be used for restoring primary molars, particularly as single-surface restorative material. It also suggests that Type VIII GIC can be more effective in restoring the primary molars as compared to the conventional Type II GIC.

**Key words:** GIC; Primary molar; Single-surface restoration; Survival; Two-surface restoration.

Conflict of Interest: None

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### INTRODUCTION

Dental caries is one of the most prevalent diseases of childhood in developing countries,<sup>1</sup> and is mostly managed with restorations by suitable restorative materials like glass ionomer, composite resin, compomer and amalgam.<sup>2</sup> The longevity of such restorations varies, depending on the material used.<sup>3</sup> Glass ionomer cements (GIC) have been a material of choice for pediatric

restorations for more than two decades because of its fluoride releasing property from the glass component, biocompatibility, chemical adhesion to dentin and enamel, coefficient of thermal expansion similar to that of tooth structure, easy placement, better marginal adaptation and versatility.<sup>4-8</sup> Results from clinical studies do not, however, support the use of glass ionomer restorations in primary molars, particularly because of its lower survival and, higher occlusal wear and fracture compared to other conventional restorative materials.<sup>9-12</sup> The survival rate of GIC in primary molars is supposed to be uninfluenced by its different supply forms (hand-mixed and encapsulated), rather it has been found to be influenced by a) the surfaces involved by caries i.e. type of cavity prepared for restoration (Class I, Class II and Class V)<sup>13</sup> and, b) the viscosity of the cement.<sup>14</sup> A study has also depicted that socioeconomic characteristics of the individuals play an important role in restoration failures, particularly the economic status and mother's education.<sup>15,16</sup>

There have been plenty of studies justifying the survival and longevity of composite restorations and showing the significant roles of socioeconomic characteristics of the individual, caries risk and occlusal risk for the individual and type of cavity.<sup>15-20</sup> However, there is a relative lack of studies depicting the same for glass ionomer restorations. This study aims to evaluate the survival of GIC restorations on primary molar teeth of dental patients attending College of Medical Sciences, Chitwan.

## METHODS

A retrospective longitudinal study was conducted after getting ethical approval from ethical review committee at College of Medical Sciences, Bharatpur. The sample involved a total of 137 patients who were treated with at least one GIC restoration in their primary

molars in the past 3 years at the dental hospital of the same institute. Patient record books containing the record of past 3 years, were used to determine the patients and their contacts. They were telephoned, informed about the research verbally and, called to the clinic for examination. Informed consent and assent of the children and their parents or legal guardians respectively, were taken prior to examination.

Inclusion criteria:

1. The primary molar tooth was restored with GIC at least 1 year back, in the same clinic.
2. The treatment was done with the GC Fuji II or GC Fuji IX GP.
3. The restoration was single-surface or two-surface type.
4. The child and his/her guardian provided consent and assent respectively, for the examination; and admitted to the clinic for the same.

Exclusion criteria:

1. There was an evidence of bruxism in the child.

### Criteria for evaluation of the outcome:

The outcome of the study was survival (with full or partial marginal integrity) or failure of the restorations (needed a repair or replacement). USPHS criteria was used to determine survival. The restoration was considered to have survived, if it was intact and didn't need more than a polishing. It was considered a failure, if it needed a re-intervention i.e. the restoration was completely dislodged/removed, partly broken, had a marginal defect of more than 0.5 mm, fractured or inflicted with secondary caries.<sup>21,22</sup> Restoration involving only occlusal or buccal or lingual surface of the primary molar, was termed as single-surface restoration. Restoration involving more than one surface i.e. MO or MOD of the primary molar, was termed as two-surface restoration.

Data were collected by single examiner by performing a clinical review of the eligible participants from January 2022 to March 2022. Data were collected to assess the demographic variables like gender, economic status and mother’s education; restoration-related variables like no of surfaces involved (Single-surface restoration / 2-surface restoration), type of material used (GIC type II / type VIII), and number of years passed after restoration (1 year / 2 years / 3 years) and; outcome related variable i.e. survival of restoration (survived / failed).

**Statistical analysis:**

Data collected were entered in MS Excel, edited, coded and analyzed using software SPSS 17.0. Descriptive statistics with frequency and percentage analysis were performed. Chi-square tests were carried out to find out the association between dependent and independent variables. Significance level of 5% was considered.

**RESULTS**

Table 1 depicts the distribution of participants with respect to their socio-demographic variables, while table 2 shows the distribution of the restorative material used, surfaces involved, age of restoration, location of tooth and outcome of restoration. It shows that restorations were done more on maxillary teeth (35.8%) compared to mandibular teeth (64.1%), and

more with Type II restorative material (64.2%) compared to Type VIII (35.8%). About three fourth (74.5%) of the restorations had survived while 25.5% of them had failed.

The survival rate of the restoration was not found to be significantly associated with location of the tooth and sociodemographic indicators like gender, age, economic status and mother’s education. (table 3) However, it was found to be associated with the type of restorative material, restorative cavity and age of restoration. Type VIII GIC was shown to have higher survival rate (85.7%) as compared to Type II GIC (68.2%). Single-surface restorations had a higher survival rate (84.9%) compared to two-surfaces restorations (52.3%). The survival rates for 1 year, 2 years and 3 years were found to be 93.5%, 78.6% and 62.5% respectively. (table 4)

The 1-year, 2 years and 3 years survival rates for single surface restorations were found to be 100%, 87.5% and 74.4% respectively, while the corresponding rates for two surface restorations were found to be 77.8%, 50% and 44% respectively. The 1-year survival rates were almost equal for Type II and Type VIII GIC (93.7% and 93.3%). However, the 2-years and 3-years survival rates were shown to be higher for Type VIII GIC than for the Type II GIC. (table 5)

**Table 1:** Distribution of participants across socio-demographic variables

Variables		Frequency	Percent
Gender	Male	72	52.6
	Female	65	47.4
Age	5 years	10	7.3
	6 years	23	16.8
	7 years	38	27.7
	8 years	43	31.4
	9 years	23	16.8
Economic status	Good	88	64.2
	Poor	49	35.8
Mother’s education	Higher education	21	15.3
	High school	46	33.6
	Literate	44	32.1
	Illiterate	23	16.8

**Table 2:** Distribution of restorative material used, surfaces involved, age of restoration, location of tooth and outcome of restoration

Variables		Frequency	Percent
Restorative material	Type II	88	64.2
	Type VIII	49	35.8
Surface involved	Single surface	93	67.9
	Two surfaces	44	32.1
Age of restoration	1 year	31	22.6
	2 years	42	30.7
	3 years	64	46.7
Location of tooth	Maxillary right	26	19.0
	Maxillary left	23	16.8
	Mandibular left	49	35.7
	Mandibular right	39	28.4
Outcome of restoration	Survived	102	74.5
	Failed	35	25.5

**Table 3:** Association of survival with gender, age, economic condition and mother's education

Variables		Outcome		Chi-square value
		Survived Frequency (Percent)	Failed Frequency (Percent)	
Gender	Male	50 (69.4)	22 (30.6)	0.174
	Female	52 (80.0)	13 (20.0)	
Age	5 years	9 (90.0)	1 (10.0)	0.342
	6 years	19 (82.6)	4 (17.4)	
	7 years	29 (76.3)	9 (23.7)	
	8 years	31 (72.1)	12 (27.9)	
	9 years	14 (60.9)	9 (39.1)	
Economic status	Good	67 (76.1)	21 (23.9)	0.547
	Poor	35 (71.4)	14 (28.6)	
Mother's education	Higher education	16 (76.2)	5 (23.8)	0.946
	High school	35 (76.1)	11 (23.9)	
	Literate	31 (70.4)	13 (29.6)	
	Illiterate	18 (78.3)	5 (21.7)	

**Table 4:** Association of survival with restorative material, restorative cavity, age of restoration and location of tooth

Variables		Outcome		Chi-square value
		Survived Frequency (Percent)	Failed Frequency (Percent)	
Restorative material	Type II	60 (68.2)	28 (31.8)	0.026
	Type VIII	42 (85.7)	7 (14.3)	
Surfaces involved	Single surface	79 (84.9)	14 (15.1)	0.000
	Two surfaces	23 (52.3)	21 (47.7)	
Age of restoration	1 year	29 (93.5)	2 (6.5)	0.004
	2 years	33 (78.6)	9 (21.4)	
	3 years	40 (62.5)	24 (37.5)	

Location of tooth	Maxillary right	22 (84.6)	4 (15.4)	0.417
	Maxillary left	17 (73.9)	6 (26.1)	
	Mandibular left	33 (67.3)	16 (32.7)	
	Mandibular right	30 (76.9)	9 (23.1)	

**Table 5:** Frequency and percentage of survival of restorations across no of surfaces involved and material used

		Age of restoration	Outcome	
			Survived Frequency (%)	Failed Frequency (%)
Surfaces involved	Single surface	1 year	22 (100)	0 (0)
		2 years	28 (87.5)	4 (12.5)
		3 years	29 (74.4)	10 (25.6)
	Two surfaces	1 year	7 (77.8)	2 (12.2)
		2 years	5 (50)	5 (50)
		3 years	11 (44)	14 (56)
Material used	Type II	1 year	15 (93.7)	1 (6.2)
		2 years	19 (73.1)	7 (26.9)
		3 years	26 (56.5)	20 (43.5)
	Type VIII	1 year	14 (93.3)	1 (6.7)
		2 years	14 (87.5)	2 (12.5)
		3years	14 (77.8)	4 (12.2)

**DISCUSSION**

In our study, the 1-3 years cumulative survival rate of the GIC restorations in primary molars was found to be 74.5% which is higher as compared to a study published in 2019 which showed that the 1-3 years survival rate of GIC restoration in primary molar tooth was 64.3%.<sup>23</sup> A study performed in 2014 revealed that the annual failure rates for conventional GIC restorations were 12.9%.<sup>11</sup> Our study depicted relatively lower failure rates as compared to that study, as 6.5% and 21.4% failure rates were observed in our study at 1 year and 2 years respectively. However, the failure rates in our study were much higher as compared to another study which showed only 1 % and 7% failures at 1 year and 2 years respectively. Our study also depicted higher 2-years failure rates for single surface restorations (12.5%) and two surface restorations (50%) than that study which showed 0% and 7% failure for single surface and two surface restorations at 2 years.<sup>14</sup>

The current study showed significantly higher survival rates for one-surface restorations compared to two-surface restorations which matches with many other studies.<sup>3,14,23,24</sup> Our study showed that Type VIII material had significantly higher survival rate as compared to Type II material. This finding doesn't match with the results of a study published in 2021 showing no significant difference in the survival rates in using Type II and Type VIII GIC.<sup>25</sup> The mismatch could be due to the difference in the methodology of the cavity preparation in the two studies. Our study employed only rotary instrumentation while the compared study employed the use of hand instruments for Type VIII material and conventional rotary instruments for Type II material.

In our study, the 1-year survival rates were found to be almost same for Type II and Type VIII material (93.7% and 93.3%) but, the 2-years and 3-years survival rates were found to be higher for Type VIII material than for Type

II material. The difference might be associated with the higher viscosity of Type VIII material compared to Type II material, because more viscous GIC have better mechanical properties, and easy insertion in the cavities using digital pressure.<sup>26</sup>

## CONCLUSION

The findings of this study suggest that GIC can be used for restoring primary molars, particularly as single-surface restorative material. It also suggests that Type VIII GIC can more effective in restoring the primary molars as compared to the conventional Type II GIC.

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