



## Parental Satisfaction of Esthetic in SDF followed by RMGI Restoration Compared to RMGI Restoration

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### Abstract

Parental satisfaction of beauty in Silver Diamine Fluoride (SDF) followed by Resin-modified Glass Ionomer Cement Restoration (RMGI) compared to RMGI restoration was investigated in this cross-sectional study. The 3-12 years old patients from the dental clinic department of Nong sue hospital, Pathum-Thani, had one or more cavitated carious lesions (ICDAS score 5) on posterior primary teeth. 43 patients participated in this study (Dec 2021 – Jan 2022). The 13 patients were excluded from this study by exclusion criteria. The remaining patients who followed the inclusion criteria were randomly assigned to SDF combined with RMGI restoration for 15 parents and RMGI restoration only as a control treatment for 15 parents. All carious lesions were collected by using Atraumatic Restorative Treatment (ART) or Interim therapeutic restoration (ITR) by an operator, followed by the SDF combined with RMGI restoration or the RMGI restoration. The 5 scores Likert scale was used to evaluate the parental esthetic satisfaction with the restoration at periodic recall 2 weeks by the questionnaires. The results showed that two weeks after the operation, the mean of parental satisfaction on SDF combined with RMGI restoration group and RMGI restoration group were 4.7 and 4.6667 respectively. The Mann-Whitney U-test was used to analyze, the result was parental satisfaction on SDF combined with the RMGI restoration group had no statistically significant difference in parental satisfaction in tooth discoloration after treatment compared with the RMGI restoration group ( $p=1.000$ ). Treatment with SDF with RMGI together was well accepted by parents. Postoperative signs and symptoms perceived by a few parents included pain, gingival swelling or irritation, and bad mouth odor, which was less likely to relate to SDF application. Black staining after SDF treatment, which is the major disadvantage of this treatment, did not affect parental satisfaction to the degree that had been feared.

**Keywords:** Parental satisfaction, RMGI restoration, Silver Diamine Fluoride, ITR/ART, ICDAS 5

### 1. Introduction

The 8<sup>th</sup> National Oral Health Survey of Thailand indicated that the high prevalence of primary and permanent dental caries in children is a major public health problem in Thailand, which needs to be restored because untreated dental caries that including pain, poor school performance, absence from school, the need of using general anesthesia during treatment, and increased treatment cost (Sabbagh et al., 2020). According to the epidemic of Coronavirus Disease 2019 (COVID-19), which routes of transmission are direct contact, droplet, and possible aerosol transmissions. Therefore, operative dental procedures which generate aerosol and direct contact with the patient's saliva were determined as high risk for transmission (Ge et al., 2020). Non-aerosol generating procedures and Interim Therapeutic Restoration (ITR) or Atraumatic Restorative treatment (ART) are recommended in the outbreak (Meng & Bian, 2020).

The ITR approach has been largely promoted by the World Health Organization (WHO) and since 1994 (Jiang et al., 2020), ITR can be used as a step-wise technique in children with multiple carious lesions then final restoration respectively. The procedure includes caries removal using slow-speed handpiece or hand instruments with caution of pulpal exposure. The leakage restoration can be decreased by caries removal from the surrounding of the lesion as much as possible. After the preparation, the tooth is restored with a resin-modified glass ionomer cement (RMGI). ITR reported a high success when use to 1-2 surface restorations (Oral Health Policy, 2017).



The used Glass-Ionomer cement (GIC) in ITR or ART has the advantage of decreasing cariogenic bacteria (Sabbagh et al., 2019). The Resin-modified Glass-Ionomer cement (RMGICs) is the interesting material in this study. In the past, RMGIs were used as liners and bases. Nowadays, RMGIs become a restorative material, to eliminate early moisture sensitivity and improve mechanical properties from GIC. RMGICs also contain resin-free radical polymerization and acid-base reaction, polyalkenoate reaction with less water to proceed as the resin is added to the expense water (Moberg et al., 2019).

Moreover, the Silver Diamine Fluoride (SDF) has the potential to arrest caries which makes the procedure easier and decreases the patient's discomfort but generating of black stain may cause esthetic concerns.<sup>8</sup> Silver diamine fluoride (SDF) or caries arrest and prevention which minimizes invasive therapy that is not expensive, SDF does not need to remove caries and is also easy to apply. SDF also gives minimal risk to patients and the black staining of carious enamel and dentin is their limitation. There are not any prior study that reports on the parenteral acceptance of using SDF and then restoring it with RMGI which is based on the benefits or the side effect of the dark color (Jiang et al., 2020).

There was a report about RMGI restored over with SDF treated by atraumatic restorative treatment (ART) approach which can make parents more satisfied with their child's primary teeth (Crystal et al., 2017). There is no evidence about the effect of bond strength of dentin on adhesive and RMGI when using SDF application (Puwanawiroj et al., 2017). Another study found that SDF did not affect the bond strength of resin composite to non-carious permanent tooth dentin (Quock et al., 2012).

The purpose of this study is to compare parental satisfaction of Resin-modified Glass Ionomer Cements (RMGI) with Silver Diamine Fluoride (SDF) combined with Resin-modified Glass Ionomer Cements (RMGI) only.

## 2. Objectives

To compare parental satisfaction of RMGI restoration with SDF treated RMGI restoration on a primary tooth with a cavitated carious lesion

## 3. Methods

Pediatric patients with ages between 3-12 years old with one or more cavitated carious lesions (ICDAS score 5) on posterior primary teeth with no sign and symptom of irreversible pulpitis, pulp necrosis, or periapical disease from the clinical and radiographic evaluation were G.V Black's classification I, II, or V of primary posterior teeth from the Nong-sue hospital dental clinic were included in the study. Any teeth cannot retain in the mouth for more than 2 years, uncooperative patients who cannot come for periodic recall, who have a history of silver, polyacrylic acid, or resin monomer allergy were excluded from the sample size.

The sample size was calculated from the formula that was used to find the representative of the pediatric patient population at the Nong sue hospital based on actual pediatric patients who received the treatment from 1st December 2020 to 29th February 2021. Form a total of 50 pediatric patients, which 95% Confident level ( $Z_{\alpha} = 1.96$ ) and Caries Prevalence of 8th Thai National oral health surveys = 0.523. The sample size would be 15 children. Therefore, the sample size from the formula would be 18 children for each group, assuming a 20% loss to follow-up.

This study was reviewed and approved by the institutional ethical review board of Rangsit University

### 1) Patient selection

1.1) Pediatric patient with age between 3-12 years old with a cavitated carious lesion (ICDAS score 5) with no sign and symptom of irreversible pulpitis, pulp necrosis, or periapical disease from clinical and radiographic (Bitewing and Periapical radiograph).

1.2) The cavities type of G.V. Black's classification I, II, or V of primary posterior teeth.

### 2) Simple random sampling

2.1) Procedure: Clean tooth surface by cotton pellet with pumice, an explorer to remove plaque before restorative application.



### 3.1) RMGI

Excavated infected dentine at surrounding wall completely, leaving the deep part nearly pulpal floor and axial wall, then gently rinse with water or wipe with a wet cotton pellet and high-power suction. The affected tooth surface was dried with a dry cotton pellet. Using gauze and cotton rolls for isolating tongue and cheek from affected teeth, also used saliva ejector and high-power suction.

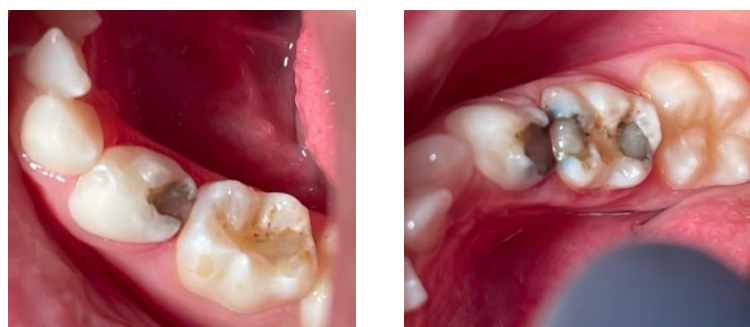
In the case of the cavity that was near the gingiva, petroleum jelly would be considered to apply to the gingiva with a cotton application. Any of the class II cavity will apply a T metal band and wooden wedge before being restored. Immerse 10% polyacrylic acid and apply for 20 s on the affected tooth surface then gently rinse with water for 20 s and high-power suction, leaving dentin moist. RMGI capsule was triturated for 10 s and applied into the cavity, then light-cured for 40 s. Check occlusion by articulating paper if any excess removes by a hand instrument or sandpaper strip. Apply GC Varnish® on the restoration surface.

### 3.2) RMGI + SDF

First completely excavated the infected dentine at the surrounding wall, leaving the deep part nearly pulpal floor and axial wall. Gently rinse water using high-power suction. Then, the affected tooth surface was dried with a dry cotton pellet and isolating tongue and cheek from the affected primary teeth using gauze and cotton roll, saliva ejector, and high-power suction.

In the case of the cavity that was near the gingiva, consider applying petroleum jelly on the gingiva with a cotton application. Apply T metal band and then wooden wedge placement and bend the microbrush applicator, immerse 10% polyacrylic acid and apply for 20 s on the affected tooth surface. Then, gently rinse water for 20 s using high-power suction, leaving moist dentin. Using 1 drop of SDF into a plastic dappen dish. Remove bulk saliva with saliva ejector and high-power suction and bend microbrush applicator, immerse it into SDF, and remove excess.

Directly Apply SDF onto the affected tooth surface with a microbrush applicator (one microbrush applicator is used for one cavity). Allow SDF to absorb for 1 minute, then remove excess with gauze or cotton roll. RMGI capsule trituration for 10s. Applying RMGI on the affected tooth surface, then light curing for 40 s. Check the occlusion by articulating paper, if any excess removes by a hand instrument or sandpaper strip. Applying GC Varnish® on restoration surface.



**Figure1** Filling with SDF followed by RMGI

#### 1) Evaluate parental esthetic acceptance

Two weeks after the treatment, a self-administered questionnaire was sent to the parents for data collection. The questionnaire contained five parts: Part1; general information, Part2; sign and symptom after treatment, Part3; masticatory function, Part 4; discomfort, and part 5; parental satisfaction. (Figure2)

Data analysis: The parental satisfaction was collected from the patient's parents 2 weeks after treatment. The Shapiro-Wilk test was used to test the normality of data. The result was the parental satisfaction data was non-panoramic. Thus, Mann-Whitney U-test was used to analyze the data via SPSS statistics software for statistical analyses  $P > 0.05$  statistical significance level.



## Questionnaire

**Instruction:** The purpose of this questionnaire is to evaluate parental satisfaction of the patient who receive restorative treatment including with silver diamine fluoride

## Part 1: General information

**Instruction:** please put the tick in the box next to the answer of your choice or write in the space provided.

1. Sex .....
2. Age ..... Years
3. Relationship .....
4. Occupation
  - ☐ Unemployed
  - ☐ Officer
  - ☐ Merchant / Own business
  - ☐ Farmer / Fisherman
  - ☐ Government official
  - ☐ Employee
  - ☐ Freelance
  - ☐ Etc. ....
5. Income
  - ☐ < 9,000 Bath
  - ☐ 9,000 - 15,000 Bath
  - ☐ 15,001 – 30,000 Bath
  - ☐ 30,001 – 50,000 Bath
  - ☐ >50,001 Bath

3. The patient has bad breath after the procedure
  - ☐ Yes
  - ☐ No
4. The patient has nausea/ vomiting after the procedure
  - ☐ Yes
  - ☐ No
5. The patient has food impaction after the procedure
  - ☐ Yes
  - ☐ No

## Part 3: Masticatory function

**Instruction:** please put the tick in the box next to the answer of your choice.

1. The patient has the problem about chewing after the procedure
  - ☐ Yes
  - ☐ No
2. The patient has taste changed after the procedure
  - ☐ Yes
  - ☐ No
3. The patient has difficult on chewing or prolong time on food consumption
  - ☐ Yes
  - ☐ No

## Part 4: Discomfort

**Instruction:** please put the tick in the box next to the answer of your choice.

1. The patient concerned about health and oral problem after the procedure
  - ☐ Yes
  - ☐ No
2. The patient concerned when smile after the procedure
  - ☐ Yes
  - ☐ No
3. The patient unsatisfied about tooth color after the procedure
  - ☐ Yes
  - ☐ No

## Part 2: Symptoms and sign after treatment

**Instruction:** please put the tick in the box next to the answer of

1. The patient has pain after the procedure
  - ☐ Yes
  - ☐ No
2. The patient has gingival swelling after the procedure
  - ☐ Yes
  - ☐ No

## Part 5: Parental satisfaction

**Instruction:** please put the tick in the box next to the answer of your choice.

Question	Satisfaction level				
	Very satisfied	Satisfied	Neutral	unsatisfied	Very unsatisfied
Parental satisfaction about masticatory function of the children after the procedure					
Parental satisfaction about pain or discomfort during operation					
Parental satisfaction about tooth coloration					

**Figure 2** The questionnaires that were used to evaluate parental satisfaction after 2 weeks of treatment.



## 4. Results and Discussion

### 4.1 Results

A total of 43 children patients were accepted for this study, and 13 children were excluded by exclusion criteria. Thirty children 2 to 10-year-old boys and girls (mean age=6 years, SD=2.73) participated in the study (boy/girl ratio=0.3). The subjects were randomized and assign to SDF + RMGI or RMGI only by simple random sampling technique. Result as 1 SDF + RMGI patient and 6 RMGI only patients. The answers to the questionnaire were taken from the patient's parents after 2 weeks. (Table1)

All the baseline examination, the lesion was treated in posterior primary teeth. By ICDAS classification, there was ICDAS 5. Carious lesions were active for 46 cavities, i.e., brown, and soft. There were 22 cavities involving one surface, 16 cavities involving two surfaces, 6 cavities involving three surfaces, and 2 cavities involving four surfaces.

Six cavities involved one surface filling with RMGI followed by SDF, five cavities involved two surfaces filling with RMGI followed by SDF, six cavities involved three surfaces filling with RMGI, followed by SDF, and two cavities involved four surfaces filling with RMGI followed by SDF.

Sixteen cavities involved one surface filling with RMGI only. Eleven cavities involved two surfaces filling with RMGI only. No cavities involved three surfaces and four surfaces filling with RMGI only.

**Table 1** The total number of patients who were accepted to this study, divided into inclusion and exclusion criteria and the number of total cavities in this study.

Inclusion criteria N=30		Exclusion criteria N=13
RMGI N=15 Parents= 15 One-surface = 6 cavities Two-surfaces = 5 cavities Three-surfaces = 6 cavities Four-surfaces = 2 cavities Total 19 cavities Parents answer questionnaire=15 Parents didn't answer questionnaire=0	SDF+RMGI N=15 Parents=15 One-surface = 16 cavities Two- surfaces = 11 cavities Three-surfaces = 0 cavities Four-surfaces = 0 cavities Total 27 cavities Parents answer questionnaire=15 Parents didn't answer questionnaire=0	13 patients were not qualified because some had extensive cavity cannot restoration, signs and symptoms of irreversible pulpitis, pulp necrosis, and periapical disease from the clinical and radiographic examination.

Table 1 showed the inclusion and exclusion criteria and the number of total cavities in this study. The overall acceptance rate in the color of SDF treated carious primary molars followed by RMGI restorations ( $n=15$ ) and RMGI restoration ( $n=15$ ) only at baseline, evaluated within 2 weeks after receiving the treatment. The normality was tested by Shapiro-Wilk, result as all data were nonparametric data.

The test of normality was less than 0.05 at the statistical significance level. Mean data were considered the nonparametric. Thus, the parental acceptance in SDF followed by RMGI and RMGI only were analyzed by the Mann-Whitney U-test via SPSS statistic.

The mean of parental satisfaction with SDF followed by RMGI restoration was 4.7 and the mean of RMGI restoration was 4.6667 which both treatment's means had no difference ( $p = 1.000$ ) in satisfaction on the beauty of restoration in each group at a statistical significance level 0.05.

In conclusion, from the Mann-Whitney test at a significance level of 0.05, neither SDF + RMGI nor RMGI affect parental acceptance of beauty ( $p= 1.000$ ) (Table2).

**Table 2** The result of statistic evaluation of parental satisfaction on esthetic.

Restoration	Patient	Mean	SD	U	p
RMGI	15	4.6667	0.40684	112.500	1.000
SDF + RMGI	15	4.7000	0.50855		

\* Statistic significance level 0.05

Moreover, the results of the questionnaires were divided into 5 parts: general information, signs, and symptoms after treatment, functional capacity after treatment, discomfort after treatment, and satisfaction after treatment.

#### General information

16 patient parents participated in this study. The majority kind of job was the vender, the freelancer, the unemployed, and the retired teacher in order. The average salary per month was 9,000 – 15,000 baht.

#### Signs and symptoms after treatment

The questionnaires included pain in the tooth or gingiva, red gingiva, malodor, nausea vomiting, and food impaction were taken from parents. Result as no patient had red gingiva, malodor, nausea vomiting. 1 patient had pain in the tooth or gingiva in RMGI only group and 2 patients had food impaction from SDF + RMGI group.

#### Functional capacity after treatment

The questionnaires included problems from occlusion, dysgeusia, and longer eating time food consumption were taken from parents. The result as no patient had functional capacity problems after treatment.

#### Discomfort after treatment

The questionnaires included worried about the dental health of the child after treatment, unconfident, and unpreferable in the color of the material. Result as no patient had worried about the dental health of the child after treatment, unconfident. 1 patient had the unpreferable color of the material from the RMGI group.

#### Satisfaction after treatment

The questionnaires included satisfaction with function, satisfaction with operation process, and satisfaction with esthetic. Results of satisfaction on function, the mean of RMGI only group was 4.8333 and mean of SDF + RMGI group was 4.8. Both had  $p = 0.775$  with no difference in satisfaction on function in each group at a statistical significance level of 0.05 (Table 3).

**Table 3** The result of statistic evaluation of parental satisfaction on function.

Restoration	Patient (s)	Mean	SD	U	p
RMGI	15	4.8333	.3051	105	0.775
SDF + RMGI	15	4.8000	.5086		

\* Statistic significance level 0.05

Satisfaction on the esthetic, the results as the mean of RMGI only was equal to 4.6667 and the mean of SDF + RMGI was equal to 4.7, which could be concluded that neither SDF + RMGI nor RMGI only, did not affect satisfaction on function ( $p = 1.000$ ) at significance level 0.05 (Table 4).

**Table 4** The result of statistic evaluation of parental satisfaction of function.

Restoration	Patient	Mean	SD	U	p
RMGI	15	4.6667	0.4068	112.500	1.000
SDF + RMGI	15	4.7000	0.5086		

\* *Statistic significance level 0.05*

#### 4.2 Discussion

Parental acceptance data were collected using a self-administrated questionnaire at two weeks postoperatively. The questions were based on previously reported postoperative signs and symptoms including pain, gingival irritation (gingival red or swelling), bad odor, nausea/vomiting, food impaction, and acceptance of the patient's parent.

In our study, the postoperative signs and symptoms in both study groups SDF with RMGI (15 parents) and control RMGI (15 parents) group were not different. Regarding the gingival irritation after the operation, this is possibly due to tooth separation and gingival retraction by T-band and wedge, or the parents could not locate pain which from the restored or unrestored tooth.

For functional acceptance including a problem with chewing, change of taste, and difficulty in chewing have not reported any problems in both groups. The patient's concerns about the oral health problems, smiling and tooth discoloration were not different in both groups.

According to the study of parental acceptance of silver diamine fluoride (Crystal et al., 2017). The factors which affected parental acceptance include income and career. Results of this study showed that all parental satisfactions were in a high score (score 4 - 5), which can be assumed the high score may cause by the patient's income and career.

Parental acceptance of tooth discoloration was generally accepted by both groups. No statistically significant difference was found in acceptance with respect to tooth discoloration between the study group and the control group. It is assumed that most of the parents were emphasizing the procedure, pain elimination, and improving or maintaining masticatory function (Kittiprawong et al., 2018).

As mentioned, neither SDF + RMGI nor RMGI affect parental acceptance of beauty ( $p = 0.958$ ) at a statistical significance level of 0.05. The factor that affected parental acceptance may be parental information before having a treatment. According to the study of the effect and acceptance of silver diamine fluoride treatment on dental caries in primary teeth (Celmens et al., 2018), carefully informing the parent can be increased the acceptance rate.

Only a few studies have investigated the efficiency of fluoride effectiveness with respect to the preferences of patients or parents and have shown that SDF can control the progression of dental caries and may reduce pain and infection. These studies could lead to the improvement of children's quality of life.

Due to the COVID-19 situation, there are some limitations, parents are concerned about the disease, moreover, the pediatric patients haven't got vaccinated so some of the parents denied receiving the treatment.

Not only parental's esthetic acceptance but also the survival and success rate from ART by RMGI and SDF+RMGI can be further studied and collect more sample sizes.

#### 5. Conclusion

Treatment with SDF with RMGI together was well accepted by parents. Postoperative signs and symptoms perceived by a few parents included pain, gingival swelling or irritation, and bad mouth odor, which was less likely to relate to SDF application. Black staining after SDF treatment, which is the major disadvantage of this treatment, did not affect parental satisfaction to the degree that had been feared.



## 6. Acknowledgement

### Ethics

The study was approved by the Ethics Review Board of Rangsit University

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### Conflict of interest

The authors have no conflict of interest.

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