



# GINGIVAL HEALTH AFTER TREATMENT WITH HALL TECHNIQUE VERSUS SILVER DIAMINE FLUORIDE IN THE MANAGEMENT OF CARIOUS PRIMARY MOLARS: RANDOMIZED CLINICAL TRIAL

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## Abstract

**Aim:** This Study aims to assess gingival health after treatment with Hall Technique Versus Silver Diamine Fluoride in the management of carious primary molars.

**Materials and methods:** Thirty primary molars were randomly allocated into two equal groups (n=15). Group I was treated using 38% Silver Diamine Fluoride and Group II was treated with Hall technique. Gingival health was assessed using a modified gingival index

**Results:** The result showed better gingival health in SDF after three months with a median MGI 0 range (0-1) compared to the median 1 range (0-2) in the HT group. Furthermore, SDF has better gingival health at six months with a median MGI 0 range (0-1) in SDF compared to 1 range (0-1) in HT. **Conclusions:** SDF showed better gingival health than HT at three months follow up; after six months, there was no statistically significant difference between the two groups.

**Keywords:** Hall technique; silver diamine fluoride; gingival health.

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## Introduction

Dental caries is one of the most common chronic diseases affecting millions globally. It is a significant cause of tooth loss, pain, and discomfort worldwide, especially among children [1]. Despite recent improvements in public awareness about oral and dental health, dental caries remain a significant problem, especially in

developing countries. It is a major cause of tooth loss, pain, and discomfort worldwide, particularly among children [2]. The primary goal in pediatric dentistry is to retain the primary teeth in the oral cavity until their physiological exfoliation to preserve arch integrity [3]. Caries, periodontal disease, root resorption, and tooth trauma commonly cause premature toothloss [4]. In



addition, untreated decay in preschool children may include an increased risk of future caries in primary and permanent dentition, pain, infections, affected growth, and increased treatment costs [5]. Conventional caries removal and cavity preparation have many unpleasant drawbacks to the patients, including local anaesthesia, thermal effects, pressure effects, time consumption, and cost-effectiveness. It is essential to identify an effective alternative method, low-cost and highly accepted by children, to avoid this severe possible problem of untreated decay [6]. The modern approach in caries management focuses on arresting the lesions and disturbing or modifying the plaque [7]. Several techniques are conducted without any carious tissue removal and thus can be carried out without the use of local anesthesia, even in deep lesions [8]. The Hall technique is one of the alternative methods of treating caries in primary molars by placing a stainless-steel crown (SSC) without tooth preparation or caries removal. It has proved to be a viable restorative option for carious primary molars leading to its successful exfoliation [7]. Silver diamine fluoride (SDF) is a nonsurgical anti-caries agent that successfully arrests dental decay, primarily delivered as a 38% concentration solution. The simplicity and efficiency of applying SDF make it an attractive alternative to the traditional method [9, 6]. Using potassium iodide (K.I.) immediately after applying silver diamine fluoride (SDF) reduces the staining of tooth structure [10]. The null hypothesis aims to assess gingival health after treatment with the Hall technique versus silver diamine fluoride with the management of carious primary molars.

## **Materials and Methods**

### **I. Study design:**

This trial is designed as a randomized clinical trial (parallel technique). It was performed at the Department of Pediatric Dentistry and Public Health, Faculty of Dentistry, Cairo University.

### **II. Study setting:**

This study has been performed on children with carious primary molars with vital pulp. The children were recruited from the Pediatric Dentistry and Dental Public Health Department Faculty of Dentistry Cairo University, The procedure is carried out by a postgraduate master's

student in a dental unit at the postgraduate clinic of the pediatric department at Cairo University- Egypt

### **III. Informed Consent**

The informed consent included detailed information in simple and understandable language about the research topic, such as possible benefits and harms, treatment procedures, researcher contact information and intervals of follow-up visits. An oral explanation of consent with details of the trial and the possibility of recruitment will be introduced to the parent, and they will be allowed to ask any questions about the study and choose whether to participate or not. Written Arabic informed consent was signed and collected from the parent or the legal guardian. Parents were informed that follow-up appointments were obligatory to assess the outcome of the treatment.

### **IV. Eligibility criteria:**

Inclusion criteria are healthy cooperative children aged 4 - 6 years with caries in primary molars within enamel/dentin with vital pulp. Exclusion criteria are the Presence of signs and symptoms of necrosis, Root caries, or a history of Spontaneous pain.

### **V. Sample size determination:**

A power analysis was designed to have adequate power to apply a two-sided statistical test of the null hypothesis that there is no difference between the gingival in management of carious primary molars with hall technique versus the silver diamine fluoride. The sample size was calculated depending on a previous study ( Fadil Elamin et al. 2019 ) as a reference. According to this study, the scores of group I was 69.5%, 24.8%, and 5.7%, while the scores of group II were 92.9%, 4.8%, and 2.3%. Minimally the study needed 24 total sample size to be able to reject the null hypothesis that the population means of the experimental and control groups are equal with probability (power) 0.8. The Type I error probability associated with this test of this null hypothesis is 0.05. The sample size was increased to 30 subjects to compensate 20% dropout. Calculated sample size = 15 per each group

### **VI. Blinding**

Neither the operator nor the patients could be blinded due to the nature of the study, but statisticians can be blinded.

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The trial was a double-blinded study, where the outcome assessor and a statistician were blinded during outcome evaluation.

## VII. Clinical procedure:

### Preoperative measures for both interventions

A clinical examination was conducted to determine if the inclusion criteria were met, the diagnostic chart was filled with all the needed information all gross food debris and loose plaque were removed without removing caries from the tooth cavity using dental spoon excavators and oral hygiene instruction was given. Standardized digital photographs were taken with a Canon EOS 700D digital camera with a light ring flash for all patients. Digital Periapical Radiographs: Standardized digital periapical radiographs were taken for all patients to ensure this is the proper case in the inclusion criteria.

### The operating phase of Intervention Groups (SDF)

In the application of SDF, gross debris was removed from cavitation; petroleum jelly was applied to the lips to reduce temporary staining if inadvertent contact with SDF. The area was isolated with a cotton roll and gingival barrier, and carious lesions and tooth tissue were dried with a gentle flow of compressed air or a cotton wool roll. Next, SDF was applied with a micro-brush directly onto the lesion or area of the tooth, being treated for at least one to 3 minutes; K.I. was applied immediately after SDF with a clean micro-brush and applied one to three times until no more white precipitate forms and postoperative instruction was given. Parents were informed that children should not eat or drink for one hour after treatment. The second application was made after 6 months [11]. The steps of the SDF application are shown in Figures (1 a-d).



Figure (1A): Pre-operative occlusal photograph.

Figure (1B): application of SDF.



Figure (1C): immediate photograph after application of sdf

Figure (1D): photograph after application of potassium iodide

### 14.6 Operating Phase of (Hall Technique)

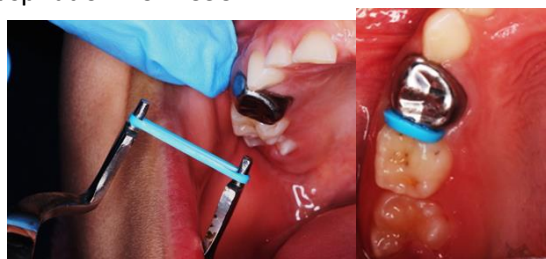
In HT, orthodontic separators were placed and removed in the next visit to create space if there is no space between the teeth. Evaluation of the tooth shape and occlusion was done to choose the correct size of the SSC that is tight enough to

give a feeling of 'spring back' during seating Then, a glass ionomer luting cement (Riva Self Cure Capsules, SDI Limited, Victoria, Australia) is placed inside the crown. The crown is pressed until it is fully seated on the tooth. Excess cement was removed, the contact areas flossed, and the



child was discharged and positioned upright in the dental chair, so there was no chance of accidental swallowing or aspiration of SSC

[12].The steps of the Hall Technique are shown in Figures (2 a-f).



**Figure (2A): Orthodontic Separator**



**Figure (2): A. Check the crown fitting; B. Fill the crown with GIC  
 C. cementation of SSC, D. asked the patient to bite in a cotton roll  
 E. remove access of cement with dental floss, F. post-operative occlusal photograph**

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**VIII. Outcome assessment:**

**Gingival health**

Was assessed at baseline using a modified gingival index, then after 3,6 months

Modified gingival index

0 = no swelling

1 = mild swelling, no bleeding after gentle probing

2 = moderate to severe gingival swelling, bleeding after air drying

**IX. Statistical methods:**

Numerical data were explored for normality by checking the distribution of data and using tests of normality (Kolmogorov-Smirnov and Shapiro-Wilk tests). Age data showed normal (parametric) distribution, while modified GI scores were non-parametric. Numerical data were presented as mean, standard deviation (SD), median, range, Inter-Quartile



Range (IQR) and 95% Confidence Interval (95% CI) for the mean values. For parametric data, Student's t-test was used to compare between mean ages values in the two groups. For non-parametric data, Mann-Whitney U test was used to compare between GI scores in the two groups. Friedman's test was used to study the changes by time within each group. Dunn's test was used for pair-wise comparisons when Friedman's test was significant. Qualitative data were presented as frequencies and percentages. Chi-square test was used for comparisons between the two groups regarding qualitative data. The significance level was set at  $P \leq 0.05$ . Statistical analysis was performed with IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.

**Results**

**Table (1): Descriptive statistics and results of Fisher's Exact test and Student's t-test for comparisons between demographic data of the two groups**

Demographic data	SDF (n = 3 patients)	Hall technique (n = 5 patients)	P-value
Gender [n, (%)]			
Boy	2 (66.7%)	3 (60%)	1
Girl	1 (33.3%)	2 (40%)	
Age [Mean, SD]	5.33 (0.58)	5 (0.71)	0.519

\*: Significant at  $P \leq 0.05$

**Teeth data**

There was no statistically significant difference between teeth types in the two groups. There was also no statistically significant difference between arch distributions in the two groups.

**Table (2): Frequencies (n), percentages (%), and results of Chi-square test for comparisons between teeth data of the two groups**

Teeth data	SDF (n = 15 teeth)		Hall technique (n = 15 teeth)		P-value
	n	%	n	%	
Tooth type					
First deciduous molar	7	46.7	4	26.7	0.256
Second deciduous molar	8	53.3	11	73.3	
Arch					
Lower	6	40	7	46.7	0.713
Upper	9	60	8	53.3	

\*: Significant at  $P \leq 0.05$

The total number of molars enrolled in this clinical trial was 30. Fifteen primary molars were recruited in each group, 38% SDF (interventional group) and Hall technique (control group), which attended the outpatient diagnostic clinic in Pediatric Dentistry and Dental Public Health Department, Faculty of Dentistry, Cairo University. This study aims to assess gingival health after treatment with the Hall Technique versus SDF in the Management of Carious Primary Molar.

**I. Demographic data**

**A. Patients' demographics**

There was also no statistically significant difference between mean age values in the two groups.



## I.1 Modified Gingival Index (GI) scores

### A. Descriptive statistics

The median, range, Inter-Quartile range (IQR), mean, standard deviation (SD), and 95% Confidence Interval for the mean values of GI scores in the two groups are presented in Table ( ).

**Table (3): Descriptive statistics for GI scores in the two groups**

showed higher GI scores than SDF with a value of

Group	Time	Median	Range	IQR	Mean	SD	95% CI for the mean
SDF (n = 15 teeth)	Baseline	0	0-1	0-1	0.4	0.51	0.12-0.68
	3 months	0	0-1	0-1	0.4	0.51	0.12-0.68
	6 months	0	0-1	0-1	0.4	0.51	0.12-0.68
Hall technique (n = 15 teeth)	Baseline	1	0-2	0-1	0.93	0.7	0.54-1.32
	3 months	1	0-2	1-1	0.87	0.52	0.58-1.15
	6 months	1	0-1	0-1	0.67	0.49	0.4-0.94

### B. Comparison between the two groups

At base line, SDF showed statistically significantly lower GI scores than Hall technique. The mean difference between GI scores in the two groups was (-0.53 with a 95% CI: -0.99- -0.07), indicating that Hall technique showed higher GI scores than SDF with a value of 0.53.

After three months, SDF showed statistically significantly lower GI scores than Hall technique. The mean difference between GI scores in the two groups was (-0.47 with a 95% CI: -0.85- -0.08), indicating that Hall technique

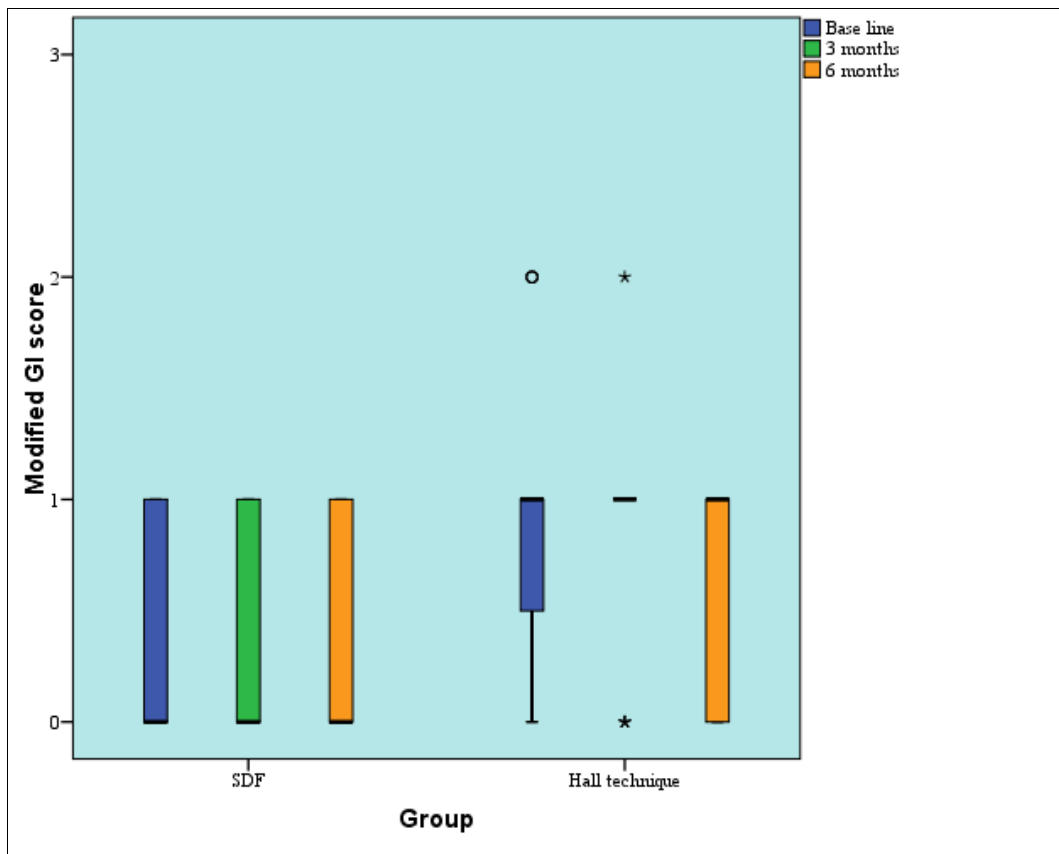
0.47.

After six months, there was no statistically significant difference between the two groups.

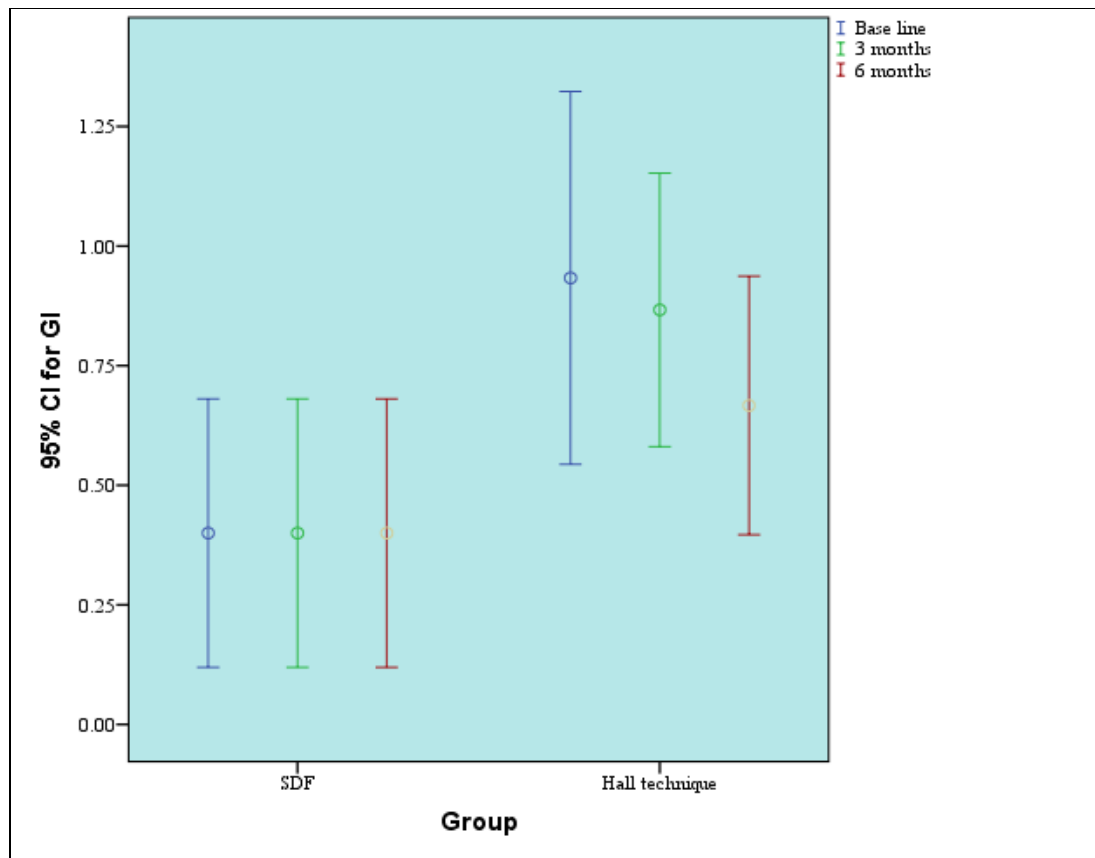
**Table (4): Descriptive statistics and results of Mann-Whitney U test for comparison between GI scores in the two groups**

Time	SDF (n = 30 teeth)		Hall technique (n = 30 teeth)		P-value	Mean difference	95% CI for the mean difference	Effect size (d)
	Median (Range)	Mean (SD)	Median (Range)	Mean (SD)				
Base line	<b>0 (0-1)</b>	0.4 (0.51)	1 (0-2)	0.93 (0.7)	0.033*	-0.53	-0.99- -0.07	0.752
3 months	<b>0 (0-1)</b>	0.4 (0.51)	1 (0-2)	0.87 (0.52)	0.022*	-0.47	-0.85- -0.08	0.78
6 months	0 (0-1)	0.4 (0.51)	1 (0-1)	0.67 (0.49)	0.150	-0.27	-0.64-0.11	0.467

\*: Significant at  $P \leq 0.05$



**Figure (3): Box plot representing median and range values for GI scores in the two groups (Circle and stars represent outliers)**



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**Figure (4): 95% Confidence Interval plot for mean GI scores in the two groups**

**C. Changes within each group**

As regards SDF group, GI scores did not change through the follow-up period, so no statistical comparison was performed.

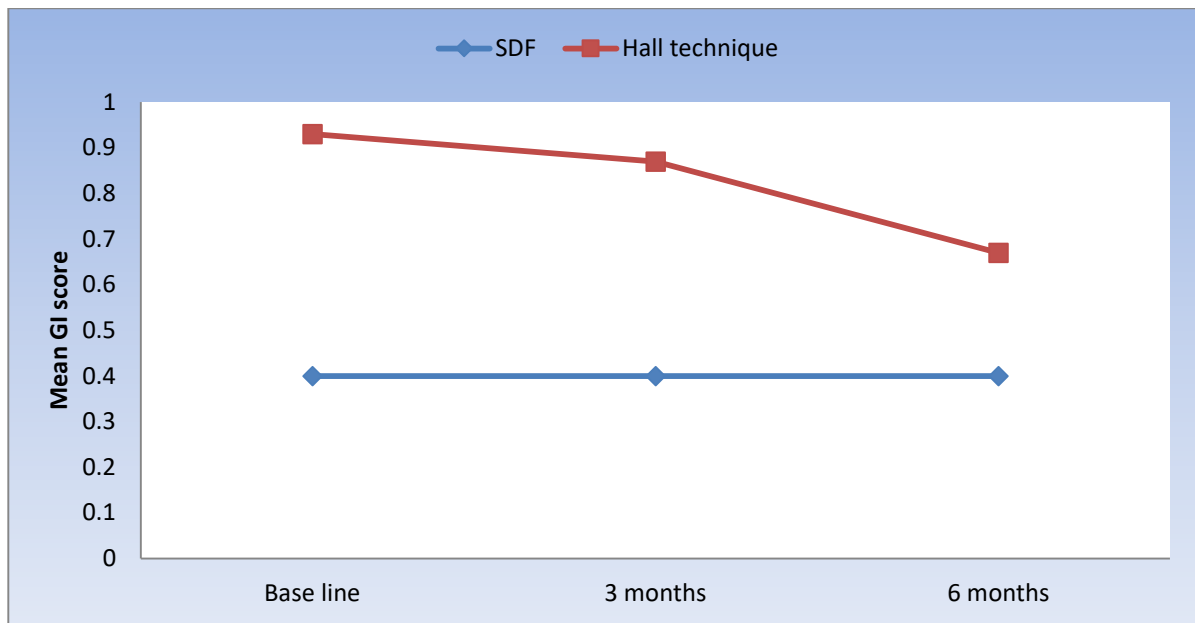
While for Hall technique group, there was no statistically significant change in GI scores by time.

**Table (5): Descriptive statistics and results of Friedman’s test for comparison between GI scores at different times within each group**

Time	SDF (n = 15 teeth)		Hall technique (n = 15 teeth)	
	Median (Range)	Mean (SD)	Median (Range)	Mean (SD)
Base line	<b>0 (0-1)</b>	0.4 (0.51)	1 (0-2)	0.93 (0.7)
3 months	<b>0 (0-1)</b>	0.4 (0.51)	1 (0-2)	0.87 (0.52)
6 months	0 (0-1)	0.4 (0.51)	1 (0-1)	0.67 (0.49)
<i>P</i> -value	Not computed		0.115	
<i>Effect size (w)</i>	Not computed		0.144	

\*: Significant at  $P \leq 0.05$





**Figure (5):** Line chart representing changes in mean GI scores in the two groups

**Discussion**

Dental caries, also known as tooth decay, is considered a public health challenge and one of the most prevalent chronic diseases of humans in the world.[10]. Once dental caries affect the tooth structure, it is essential to use conservative procedures that prevent the progress of the lesion and minimize healthy tooth structure wear [6].Untreated caries impacts the quality of life, dietary intake, child's educational development, and family's economic status. In addition, children with ECC have problems with their growth and development, speech disorder, and adverse effect on their permanent teeth. The prevalence of preschooler dental caries was associated with age and oral hygiene, with caries being more common among the six-year-olds [13].

Over the last few years, conventional restorations for treating active carious lesions in primary teeth have been challenged, and a more biological approach has been suggested. This involves less invasive techniques [14, 15]. Based on preserving tooth structure and maintaining function for as long as possible until exfoliation. Many of these approaches fall under the realm of minimal intervention dentistry (MID). [15]

The Hall technique is one of the methods used nowadays for sealing caries in primary molars [12]. It is a successful technique for managing dentine caries in primary molars,

particularly for proximal or multi-surface lesions. It is well-tolerated by children and acceptable to parents, with very mild adverse effects [15]. Shorter treatment time of the Hall technique supports its consideration as an alternative to the conventional technique [16].

The American Dental Association (ADA) and the American Academy of Pediatric Dentistry (AAPD) strongly recommend the use of 38% SDF as a part of a comprehensive management plan to arrest active cavitated lesions on primary teeth for uncooperative and young children as well as those with special health care [17].

There was no available data to determine whether HT was better than the topical use of 38% SDF[14].So a randomized clinical trial to compare them is needed. This trial suggested no difference between Hall technique and 38% Silver diamine fluoride in gingival health.

This study was performed to assess gingival health after treatment with hall technique versus Silver diamine fluoride in managing carious primary molars because no study or available data comparing the hall technique and SDF.

A randomized clinical trial (RCT) with a parallel technique was used in this Study; RCT is considered to be evidence of the highest grade. Using data provided by (Elamin et al. 2019), 30 teeth were enrolled as a representative sample size of the target population and large enough to

provide a reliable estimate of prevalence. A random sequence was generated by the assistant Supervisor and was formulated in 2 columns using the website (<http://www.random.org/>).

Clinical photographs were taken with a digital camera at baseline and follow-up appointments for legal documentation, publishing, education, and communication with patients, dental team members, and colleagues [19]. Although photographs in SDF help record and assess the status of the carious lesion and whether lesions have progressed, it is more accurate than relying on memory or written descriptions. [10]

Clinical examination and periapical Radiographs were taken to assess if the tooth would be included in the study according to inclusion criteria at baseline. In addition, periapical Radiographs was taken at follow-up appointments in 6 months for recurrent caries detection and assessment of dental infections, trauma, or pathological findings.[20]

In the Hall technique, orthodontic separators were placed and removed in the next visit to create space if there is no space between the teeth, the tooth shape and occlusion was evaluated and the SSC was checked without fully seating, Tooth surfaces were cleaned, a glass ionomer luting cement (Riva Self Cure Capsules, SDI Limited, Victoria, Australia) is placed inside the crown and positioned partially on the tooth using a finger. The patient bit on a cotton roll, until it fully seated, the Excess cement was removed, and postoperative instruction was given.[12]

In the SDF group, tooth surfaces were cleaned with gauze and isolated using cotton rolls. The lips and surrounding gingival tissues were protected using petroleum jelly to prevent any irritation or staining before applying 38% SDF (Riva Star, SDI Limited, Victoria, Australia). There was no caries removal of affected or infected dentin to achieve caries arrest (zombie effect). A micro brush was used for application of SDF. A gentle flow of compressed air was then used to dry the tooth for at least one minute after that a new micro brush was used Riva Star KI was applied till the white reactant became clear. The tooth was isolated for up to three minutes, and postoperative instruction was given. [23, 10]

Gingival health was assessed using a modified gingival index because, in clinical research, the Modified Gingival Index (MGI) is a commonly used method for assessing the gingiva without performing invasive periodontal probing. [21]

After the screening, patients who fulfilled the inclusion criteria were randomized until the minimum number of 15 teeth for each group was reached. There was no dropout during the follow-up appointment, and no clinical endpoint was reached in both group. Therefore, the analysis included 15 teeth in HT and 15 in SDF.

In this study, according to demographic data, there was no statistically significant difference between gender distributions in the two groups. There was also no statistically significant difference between mean age values in the two groups.

The statistical analysis of gingival health after three months showed the median MGI was 0 range (0-1) in the SDF group compared to the 1 range (0-2) in the HT group by a mean of 0.47 GI score than the hall with a maximum probability of reduced gingival health by 0.85 GI score and minimum probability by gingival health by reducing 0.08 GI score. Furthermore, there is 95% confidence that the SDF significantly has better gingival health at six months by a mean of 0.27 GI score than the hall with a median MGI 0 range (0-1) in SDF compared to 1 range (0-1) in HT.

This study showed a result going with *Kaptan et al. 2021*. There was a significant decrease in gingival scores in the H.T. group after six months of using the gingival index, the same measuring method. Unfortunately, according to SDF, no available data or studies measured gingival health after application in children.

#### Conclusion

According to the results of the current study, the following can be concluded SDF show lower GI score than HT.

#### Clinical cases

**Case (1)** A five years old boy diagnosed with multi-carious primary molars, upper left , and right first primary molar. Treated with HT.

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**Baseline photographs and radiographs**



**Immediate postoperative photographs and radiographs**



**6 Month follow-up photographs and radiographs**

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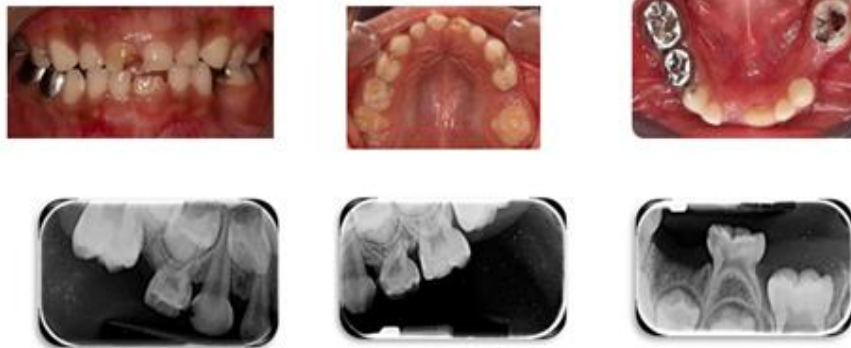
**Case 2: A five years old boy diagnosed with multi-carious primary molars, lower left second molar, and upper right and left first primary molar. Treated with 38% SDF and KI application**



**Baseline photographs and radiograph**



**Postoperative Photographs**



**6 Month photographs and radiographs**

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## References

- [1] Bhayat, A., Ahmad, M. S., Hifnawy, T., Mahrous, M. S., Al-Shorman, H., Abu-Naba'a, L., & Bakeer, H. (2013). Correlating dental caries with oral bacteria and the buffering
- [2] Al-Meedani, L. A., & Al-Dlaigan, Y. H. (2016). Prevalence of dental caries and associated social risk factors among preschool children in Riyadh, Saudi Arabia. *Pakistan journal of medical sciences*, 32(2), 452–456.
- [3] Pitchiah, P. A., & Shivashankarappa, P. G. (2020). *Rotary Files in Pediatric Dentistry: From Then Till Now*. *J Sci Dent*, 10(2), 55-57.
- [4] Ockell NM, Bågesund M. Reasons for extractions, and treatment preceding caries-related extractions in 3–8 year-old children. *European Archives of Paediatric Dentistry*. 2010;11(3):122-30
- [5] Clemens, J., Gold, J., & Chaffin, J. (2018). Effect and acceptance of silver diamine fluoride treatment on dental caries in primary teeth. *Journal of public health dentistry*, 78(1), 63-68.
- [6] Chowdhry, S., Saha, S., Samadi, F., Jaiswal, J. N., Garg, A., & Chowdhry, P. (2015). Recent vs conventional methods of caries removal: a comparative in vivo study in pediatric patients. *International journal of clinical pediatric dentistry*, 8(1), 6.
- [7] Clark, W., Geneser, M., Owais, A., Kanellis, M., & Qian, F. (2017). Success rates of Hall technique crowns in primary molars: a retrospective pilot study. *Gen Dent*, 65(5), 32-5.
- [8] Hu, S., BaniHani, A., Nevitt, S., Maden, M., Santamaria, R. M., & Albadri, S. (2022). Hall technique for primary teeth: A systematic review and meta-analysis. *Japanese Dental Science Review*, 58, 286-297.
- [9] Ruff, R. R., Whittemore, R., Grochecki, M., Bateson, J., & Barry Godin, T. J. (2022). Silver diamine fluoride and oral health-related quality of life: A review and network meta-analysis. *PloS one*, 17(2), e0261627
- [10] Horst, J. A., Ellenikiotis, H., Milgrom, P. M., & UCSF Silver Caries Arrest Committee. (2016). UCSF protocol for caries arrest using silver diamine fluoride: rationale, indications, and consent. *Journal of the California Dental Association*, 44(1), 16.
- [11] Seifo, N., Robertson, M., MacLean, J., Blain, K., Grosse, S., Milne, R., & Innes, N. (2020). *The use of silver diamine fluoride (SDF) in dental practice*. *British Dental Journal*, 228(2), 75-81.
- [12] Altoukhi, D. H., & El-Housseiny, A. A. (2020). Hall technique for carious primary molars: a review of the literature. *Dentistry journal*, 8(1), 11.
- [13] Masumo, R. M., Ndekero, T. S., & Carneiro, L. C. (2020). Prevalence of dental caries in deciduous teeth and oral health related quality of life among preschool children aged 4–6 years in Kisarawe, Tanzania. *BMC Oral Health*, 20(1), 1-10.
- [14] BaniHani, A., Santamaría, R. M., Hu, S., Maden, M., & Albadri, S. (2022). Minimal intervention dentistry for managing carious lesions into dentine in primary teeth: an umbrella review. *European Archives of Paediatric Dentistry*, 23(5), 667-693.
- [15] Hu, S., BaniHani, A., Nevitt, S., Maden, M., Santamaria, R. M., & Albadri, S. (2022). Hall technique for primary teeth: A systematic review and meta-analysis. *Japanese Dental Science Review*, 58, 286-297.
- [16] Ebrahimi, M., Shirazi, A. S., & Afshari, E. (2020). Success and behavior during atraumatic restorative treatment, the Hall technique, and the stainless steel crown technique for primary molar teeth. *Pediatric dentistry*, 42(3), 187-192.
- [17] Slayton, R. L., Urquhart, O., Araujo, M. W., Fontana, M., Guzmán-Armstrong, S., Nascimento, M. M., ... & Carrasco-Labra, A. (2018). Evidence-based clinical practice guideline on nonrestorative treatments for carious lesions: a report from the American Dental Association. *The Journal of the American Dental Association*, 149(10), 837-849.
- [18] Elamin, F., Abdelazeem, N., Salah, I., Mirghani, Y., & Wong, F. (2019). A randomized clinical trial comparing Hall vs conventional technique in placing preformed metal crowns from Sudan. *PLoS One*, 14(6), e0217740.
- [19] Casaglia, A., De Dominicis, P., Arcuri, L., Gargari, M., & Ottria, L. (2015). Dental photography today. Part 1: basic concepts. *ORAL & implantology*, 8(4), 122.
- [20] Kühnisch, J., Anttonen, V., Duggal, M. S., Spyridonos, M. L., Rajasekharan, S., Sobczak, M & Tsiklakis, K. (2020). *Best clinical practice*



*guidance for prescribing dental radiographs in children and adolescents: an EAPD policy document. European Archives of Paediatric Dentistry, 21, 375-386.*

[21] Fischman, S. L. (1986). *Current status of indices of plaque. Journal of clinical periodontology, 13(5), 371-374.*

[22] Kaptan, A., & Korkmaz, E. (2021). *Evaluation of success of stainless steel crowns placed using the hall technique in children with high caries risk: A randomized clinical trial. Nigerian journal of clinical practice, 24(3), 425-425.*