POSTOPERATIVE PAIN FOLLOWING RESTORATION WITH SONIC FILL VERSUS COMPOSITE RESIN IN CHILDREN WITH DEEP CARIOUS FIRST PERMANENT MOLAR

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ABSTRACT

Introduction: For many years, composite resin restorations have been considered an acceptable treatment choice for anterior applications. Recent advances in composite resin mechanical properties and improved adhesive systems have broadened the application of these materials to include the restoration of posterior teeth.[4] However, it is still generally accepted that posterior composite resin restorations have limitations and that there is no ideal material available.[5] A volumetric shrinkage occurs when a composite resin material is cured.[1] New nanohybrid composite activated by sonic energy has been recently introduced as a single- step, bulk-fill restorative material. **Aim:** The aim of this study is to assess the postoperative pain following restoration with sonic fill versus composite resin in children with deep carious first permanent molars. **Methodology:** The study was performed on 32 carious first permanent molars (16 in each group) in children of age 6-9 years attending the outpatient clinic in Pediatric Dentistry and Dental Public Health Department - Faculty of Dentistry - Cairo University. Clinical examination was performed for each molar to confirm its adherence to the eligibility criteria. Caries removal was performed for each molar. Random sequence and allocation concealment to avoid selection bias between both groups were performed. Follow-up at three, six and nine months for all molars took place. **Results:** There was no postoperative pain in the majority of cases in both groups and the difference between the two groups was not statistically significant from baseline to the end of the follow-up period. As regards the USPHS Criteria in the study, marginal discoloration (enamel) and anatomical form were similar presenting alpha in different follow up periods in both restorations. Both groups were nearly similar at different follow up periods regarding secondary caries. **Conclusion:** The sonic placement system had comparable results to incrementally placed conventional composite resin in terms of clinical success.

Key Words: Composite Resin, Sonic Fill, Deep Carious Tooth, First Permanent Molar, Post-operative Pain.
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INTRODUCTION

Dental caries is defined as a chronic disease which affects people all over the world of all ages and a common dental health problem within school children globally. When a great amount of tooth structure is destroyed by caries, restorative treatment can restore function, improve esthetics and/or phonetics.[15]

Despite recent scientific developments in restorative dentistry, adhesive restorations can eventually acquire secondary caries and display marginal discoloration, microleakage, postoperative pain, and other issues that can result in restoration failure.[8]

The resin-based composite restorations (RBCs) have become a commonly used technique in the dental field and exhibit a good clinical performance for restoration of posterior teeth. Although composite restorative materials have improved during the last several years, polymerization shrinkage and placement technique of the restoration plays an important role for the success rate.[7]

Postoperative discomfort is a factor in RBCs direct restoration failure. According to the hydrodynamic theory, any alteration in fluid pressure and movement would activate pain receptors in the pulp, resulting in postoperative pain after the installation of resin composite restorations.[2] As a large number of improved resin brands are being introduced in the market, it is important for dentists to be aware of the possible longevity and possible sources of failure in posterior composite restorations.[3]

The SonicFill™ composite was introduced to the market by Kerr Company. Sonic fill composite is made of a patented resin with a high degree of filling combined with unique modifying agents that respond to sonic radiation, ensuring noticeable effects in the lateral areas. SonicFill is one of the systems available on the world market of the field dedicated exclusively to the treatment of deep caries. It transforms viscous material into semiliquid material.[16] Sonic fill transforms tedious, repetitive posterior restorations into easy and reliable single fill placement up to 5 mm in depth in a single increment, without any liner or capping layer as it is flowable during placement. The high flexural strength (186 MPa) and compressive strength (254 MPa) of the Sonic Fill composite is comparable, or even great than several conventional universal composites.[10]

Other favorable physical properties of Sonic fill are volumetric polymerization shrinkage 1.88% second to Filtek LS (3M ESPE) which has the lowest shrinkage, flexural strength 136.81 MPa, fracture toughness 0.56 MPa $m^{1/2}$ and percent porosity 0.02 and thereby, lengthen their service life in the oral cavity, while still maintaining their esthetic value. Sonic-activated flowable composite restorations have shown better marginal sealing and fewer voids.[11] Thus, the aim of this study is to assess the postoperative pain following restoration with composite resin versus sonic fill in children with deep carious first permanent molars.

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PARTICIPANTS AND METHODS

Children attending the Pediatric Dentistry and Dental Public Health Department, Faculty of Dentistry, Cairo University were screened for diagnosis of their chief complaint. Thirty-two children aged 6-9 years were enrolled in this study according to their compatibility with eligibility criteria. Written informed consent was taken from the legal guardian of each patient. The study proposal was reviewed and approved by the Research Ethics Committee (REC) of the Faculty of Dentistry, Cairo University, Egypt.

Eligibility Criteria:

⇒ Inclusion Criteria:

- Asymptomatic First Permanent Molar
- Age of the patient ranging from 6-9 years
- Normal periodontal status
- Teeth with no previous restorative treatment
- Good oral health
- Absence of pathological mobility

⇒ Exclusion Criteria:

- Adverse medical history
- Potential behavioral problems
- Parents refusing participation of their children
- Pin-pointed exposure

Restorative Procedures:

A diagnostic chart was filled with personal, medical, and dental history for each participant. For each molar a periapical digital radiograph was performed prior to the treatment management to select the teeth with deep cavities.

For both groups:

Administration of local anesthetic agent in the desired area (INIBSA, Artinibsa 4% articane and 1:100,000 adrenaline, Spain). Isolation of the operative area with rubber dam was performed as shown in **Figure (1).** Access to the caries lesion was obtained with a high-speed spherical diamond bur (03/801, Microdont, Brazil). After complete removal of all decalcified tissue enamel and dentine were etched with 37% phosphoric acid (Meta- Etchant, Meta Biomed, South Korea) applied for 15 seconds. Washing was performed by triple way syringe for 5-10 minutes and then drying followed by application of the Bond (3M, ESPE-single bond adhesive, USA) with the help of a thin brush and light cured for 20 Seconds.

For Intervention Group:

Application of sonic fill tip to fill the cavity in a single step along with slight adaptation to enable proper flow of the resin material through the cavity. This was performed using the Sonic Fill handpiece (Kerr, USA) adjusted priorly as in **Figure (2)** with the attached resin tube with the sonic fill 3 composite shade A2 (Kerr, USA) in **Figure (3)**. Further adaptation with gold plated ball burnisher (499/4T, Medesy, Italy) was used to ensure the

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final restoration shape before light cure. Light cure of the composite for 20 seconds evenly was performed with the same LED-curing unit (Elipar S10; 3M ESPE, USA) while emitting a continuous light intensity mode of 1200mW/cm^2.
Articulating paper (Blue- Red articulating paper, SWE Dent, Sweden) was used to establish appropriate occlusal morphology and contact. Finishing to ensure no high spots was performed by white finishing stone (Dura white stone RA FL2, SHOFU INC., Japan).
Polishing the tooth surface with (Diamond Polish Mint 0.5 µm 2pk Mini Refill, UltraDent, USA) was done with the help of a rubber cup (Kenda CGI Polisher Kit, Switzerland).

For Control Group:

Application of Conventional composite resin to fill the cavity in an incremental technique along with slight adaptation with two different gold-plated applicators one was ball burnisher (499/4T, Medesy, Italy) and the other one was plastic instrument (499/2T, Medesy, Italy) in each step to enable seal along the walls through the cavity. Tooth was restored with conventional resin using 3M Filtek Z350 XT A2 shade (3M ESPE, USA). Light cure of the composite for 20 seconds evenly was performed with the same LED-curing unit (Elipar S10; 3M ESPE, USA) while emitting a continuous light intensity mode of 1200mW/cm^2.

Figure (1): A photograph showing rubber dam isolation of a carious lower right first permanent molar

Figure (2): A photograph showing sonic fill hand piece

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Figure (3): A photograph showing A2 Shade Sonic-Fill placement system

Clinical Evaluation

All restorations were clinically evaluated by one outcome accessor who was blind to both groups at baseline, 3, 6, and 9 months. Postoperative pain was evaluated at baseline (24 hours), 1 week, 1, 3, 6, and 9 months.

The modified United States Public Health Service (USPHS) criteria for tooth color stability, surface texture, anatomical form, marginal integrity (Enamel), marginal discoloration (Enamel), secondary caries and restoration color stability were evaluated as well and recorded in the diagnostic chart.

Statistical Analysis

Categorical data were presented as frequencies and percentages and were analyzed using chi square test for intergroup comparisons and Cochran q test followed by pairwise comparisons utilizing multiple McNemar's tests with Bonferroni correction for intragroup comparisons. Numerical data were presented as mean and standard deviation values and were tested for normality using Shapiro-Wilk's test. Parametric data (age) were analyzed using independent t-test, while non-parametric data (def, DMF scores) were analyzed using Mann-Whitney U test. Ordinal data were presented as frequencies and percentages and were analyzed using Mann-Whitney U test for intergroup comparisons and Friedman's test followed by Nemenyi post hoc test for intragroup comparisons. The significance level was set at $p \leq 0.05$ for all tests. Statistical analysis was performed with R statistical analysis software version 4.1.3 for Windows[1].

[1]R Core Team (2022). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

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Post-operative pain

1-Inter-group comparison:

After 24 hours following treatment, 14 out of 16 cases (87.50%) in the intervention group reported no pain while 2 out of 16 cases (12.50%) reported pain. As regards the control group, 13 out of 16 cases (81.20%) reported no pain while 3 out of 16 cases (18.80%) reported pain.

At 1 week follow up period, 12 out of 16 cases (75.00%) in the intervention group reported no pain while 4 out of 16 cases (25%) reported pain. As regards the control group, 13 out 16 cases (81.20%) reported no pain while 3 out of 16 cases (18.80%) reported pain.

At 1 month follow up period, 14 out of 16 cases (87.50%) in the intervention group reported no pain while 2 out of 16 cases (12.50%) reported pain. As regards the control group, 14 out 16 cases (87.50%) reported no pain while 2 out of 16 cases (12.50%) reported pain.

At 3 months follow up period, 15 out of 16 cases (93.80%) in the intervention group reported no pain while 1 out of 16 cases (6.20%) reported pain. As regards the control group, 15 out 16 cases (93.80%) reported no pain while 1 out of 16 cases (6.20%) reported pain.

At 6 & 9 months follow up periods, 100% of cases in the intervention & control groups reported no pain as shown in **Table (1)**.

2-Intra-group comparison:

For both groups, there was no statistically significant difference between values measured at different follow-up intervals ($p>0.05$) as shown in **Table (1).**

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Follow-up	Post-operative pain		Intervention	Control	*p*-value
Baseline (24 Hours)	No	n	14	13	1ns
		%	87.50%	81.20%	
	Yes	n	2	3	
		%	12.50%	18.80%	
1 week	No	n	12	13	1ns
		%	75.00%	81.20%	
	Yes	n	4	3	
		%	25.00%	18.80%	
1 month	No	n	14	14	1ns
		%	87.50%	87.50%	
	Yes	n	2	2	
		%	12.50%	12.50%	
3 months	No	n	15	15	1ns
		%	93.80%	93.80%	
	Yes	n	1	1	
		%	6.20%	6.20%	
6 months	No	n	16	16	NA
		%	100.00%	100.00%	
	Yes	n	0	0	
		%	0.00%	0.00%	
9 months	No	n	16	16	NA
		%	100.00%	100.00%	
	Yes	n	0	0	
		%	0.00%	0.00%	
p-value			0.126ns	0.244ns	

NA: Not Applicable, *; significant ($p \leq 0.05$) ns; non-significant ($p>0.05$)

Table (1): Frequencies (n) and Percentages (%) of Post-operative Pain in both groups

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Clinical Evaluation (ITT)

1. Tooth Color Stability:

Inter-group Comparison:

For all follow-up intervals, the difference between both groups was not statistically significant (p>0.05). After 3 months, 7 out 16 cases (43.80%) in the intervention group were successful while the rest of cases failed (56.20%). As regards the control group 8 out of 16 cases (50.00%) were successful while the rest of cases failed (50.00%).

After 6 months follow up, 5 out of 16 cases (31.20%) in the intervention group were successful while the rest of cases failed (68.80%). Regarding the control group, 10 out of 16 cases (62.50%) were successful while the rest of cases failed (37.50%).

After 9 months follow up, 6 out 16 cases (37.50%) in the intervention group were successful while the rest of cases failed (62.50%). As regards the control group 9 out of 16 cases (56.20%) were successful while the rest of cases failed (43.80%) as shown in **Table (2) & Figures (4), (5), (6), (7)**.

Intra-group Comparison:

For both groups, there was no statistically significant difference between values measured at different follow-up intervals (p>0.05) as shown in **Table (2)**.

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Follow-up	Tooth color stability		Intervention	Control	*p*-value
3 months	Success	n	7	8	1ns
		%	43.80%	50.00%	
	Failure	n	9	8	
		%	56.20%	50.00%	
6 months	Success	n	5	10	0.156ns
		%	31.20%	62.50%	
	Failure	n	11	6	
		%	68.80%	37.50%	
9 months	Success	n	6	9	0.479ns
		%	37.50%	56.20%	
	Failure	n	10	7	
		%	62.50%	43.80%	
p-value			0.766ns	0.776ns	

*; significant ($p \leq 0.05$) ns; non-significant ($p>0.05$)

Table (2): Frequencies (n) and percentages (%) of Tooth Color Stability in both groups according to clinical evaluation

2. Surface Texture:

Inter-group Comparison:

For all follow-up intervals, the difference between both groups was not statistically significant ($p>0.05$). After 3 months, 9 out 16 cases (56.20%) in the intervention group were successful while the rest of cases failed (43.80%). As regards the control group 7 out of 16 cases (43.80%) were successful while the rest of cases failed (56.20%).

After 6 months follow up, 7 out of 16 cases (43.80%) in the intervention group were successful while the rest of cases failed (56.20%). Regarding the control group, 7 out of 16 cases (43.80%) were successful while the rest of cases failed (56.20%).

After 9 months follow up, 9 out 16 cases (56.20%) in the intervention group were successful while the rest of cases failed (43.80%). As regards the control group 8 out of 16 cases (50.00%) were successful while the rest of cases failed (50.00%) as shown in **Table (3) & Figures (4), (5), (6), (7)**.

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Intra-group Comparison:

For both groups, there was no statistically significant difference between values measured at different follow-up intervals (p>0.05) as shown in **Table (3)**.

Follow-up	Surface texture		Intervention	Control	*p*-value
3 months	Success	n	9	7	0.724ns
		%	56.20%	43.80%	
	Failure	n	7	9	
		%	43.80%	56.20%	
6 months	Success	n	7	7	1ns
		%	43.80%	43.80%	
	Failure	n	9	9	
		%	56.20%	56.20%	
9 months	Success	n	9	8	1ns
		%	56.20%	50.00%	
	Failure	n	7	8	
		%	43.80%	50.00%	
p-value			0.716ns	0.920ns	

*; significant ($p \leq 0.05$) ns; non-significant (p>0.05)

Table (3): Frequencies (n) and percentages (%) of Surface Texture in both groups according to clinical evaluation

3. Anatomical Form:

Inter-group Comparison:

For all follow-up intervals, the difference between both groups was not statistically significant (p>0.05). After 3 months, 12 out 16 cases (75.00%) in the intervention group were successful while the rest of cases failed (25.00%). As regards the control group 8 out of 16 cases (50.00%) were successful while the rest of cases failed (50.00%).

After 6 months follow up, 11 out of 16 cases (68.80%) in the intervention group were successful while the rest of cases failed (31.20%). Regarding the control group, 10 out of 16 cases (62.50%) were successful while the rest of cases failed (37.50%).

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After 9 months follow up, 14 out 16 cases (87.50%) in the intervention group were successful while the rest of cases failed (12.50%). As regards the control group 11 out of 16 cases (68.80%) were successful while the rest of cases failed (31.20%) as shown in **Table (4) & Figures (4), (5), (6), (7)**.

Intra-group Comparison:

For both groups, there was no statistically significant difference between values measured at different follow-up intervals ($p>0.05$) as shown in **Table (4)**.

Follow-up	Anatomical form		Intervention	Control	*p*-value
3 months	Success	n	12	8	0.237ns
		%	75.00%	50.00%	
	Failure	n	4	8	
		%	25.00%	50.00%	
6 months	Success	n	11	10	1ns
		%	68.80%	62.50%	
	Failure	n	5	6	
		%	31.20%	37.50%	
9 months	Success	n	14	11	0.392ns
		%	87.50%	68.80%	
	Failure	n	2	5	
		%	12.50%	31.20%	
p-value			0.438ns	0.543ns	

*; significant ($p \leq 0.05$) ns; non-significant ($p>0.05$)

Table (4): Frequencies (n) and percentages (%) of Anatomical Form in both groups according to clinical evaluation

4. Marginal Integrity (Enamel):

Inter-group Comparison:

For all follow-up intervals, the difference between both groups was not statistically significant ($p>0.05$). After 3 months, 9 out 16 cases (56.20%) in the intervention group were successful while the rest of cases failed (43.80%). As regards the control group 6 out of 16 cases (37.50%) were successful while the rest of cases failed (62.50%).

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After 6 months follow up, 7 out of 16 cases (43.80%) in the intervention group were successful while the rest of cases failed (56.20%). Regarding the control group, 6 out of 16 cases (37.50%) were successful while the rest of cases failed (62.50%).

After 9 months follow up, 7 out 16 cases (43.80%) in the intervention group were successful while the rest of cases failed (56.20%). As regards the control group 7 out of 16 cases (43.80%) were successful while the rest of cases failed (56.20%) as shown in **Table (5) & Figures (4), (5), (6), (7)**.

Intra-group Comparison:

For both groups, there was no statistically significant difference between values measured at different follow-up intervals (p>0.05) as shown in **Table (5)**.

Follow-up	Marginal integrity (Enamel)		Intervention	Control	*p*-value
3 months	Success	n	9	6	0.479ns
		%	56.20%	37.50%	
	Failure	n	7	10	
		%	43.80%	62.50%	
6 months	Success	n	7	6	1ns
		%	43.80%	37.50%	
	Failure	n	9	10	
		%	56.20%	62.50%	
9 months	Success	n	7	7	1ns
		%	43.80%	43.80%	
	Failure	n	9	9	
		%	56.20%	56.20%	
p-value			0.716ns	0.917ns	

*; significant ($p \leq 0.05$) ns; non-significant (p>0.05)

Table (5): Frequencies (n) and percentages (%) of Marginal Integrity (Enamel) in both groups according to clinical evaluation

5. Marginal Discoloration (Enamel):

Inter-group Comparison:

For all follow-up intervals, the difference between both groups was not statistically significant (p>0.05). After 3 months, 10 out 16 cases (62.50%) in the intervention group were

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successful while the rest of cases failed (37.50%). As regards the control group 8 out of 16 cases (50.00%) were successful while the rest of cases failed (50.00%).

After 6 months follow up, 9 out of 16 cases (56.20%) in the intervention group were successful while the rest of cases failed (43.80%). Regarding the control group, 9 out of 16 cases (56.20%) were successful while the rest of cases failed (43.80%).

After 9 months follow up, 12 out 16 cases (75.00%) in the intervention group were successful while the rest of cases failed (25.00%). As regards the control group 9 out of 16 cases (56.20%) were successful while the rest of cases failed (43.80%) as shown in **Table (6) & Figures (4), (5), (6), (7)**.

Intra-group Comparison:

For both groups, there was no statistically significant difference between values measured at different follow-up intervals ($p>0.05$) as shown in **Table (6)**.

Follow-up	Marginal discoloration (Enamel)		Intervention	Control	*p*-value
3 months	Success	n	10	8	0.722ns
		%	62.50%	50.00%	
	Failure	n	6	8	
		%	37.50%	50.00%	
6 months	Success	n	9	9	1ns
		%	56.20%	56.20%	
	Failure	n	7	7	
		%	43.80%	43.80%	
9 months	Success	n	12	9	0.457ns
		%	75.00%	56.20%	
	Failure	n	4	7	
		%	25.00%	43.80%	
p-value			0.529ns	0.920ns	

*; significant ($p \leq 0.05$) ns; non-significant ($p>0.05$)

Table (6): Frequencies (n) and percentages (%) of Marginal Discoloration (Enamel) in both groups according to clinical evaluation

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6. Secondary Caries:

Inter-group comparison:

For all follow-up intervals, the difference between both groups was not statistically significant (p>0.05). After 3 months, 12 out 16 cases (75.00%) in the intervention group were successful while the rest of cases failed (25.00%). As regards the control group 10 out of 16 cases (62.50%) were successful while the rest of cases failed (37.50%).

After 6 months follow up, 11 out of 16 cases (68.80%) in the intervention group were successful while the rest of cases failed (31.20%). Regarding the control group, 12 out of 16 cases (75.00%) were successful while the rest of cases failed (25.00%).

After 9 months follow up, 14 out 16 cases (87.50%) in the intervention group were successful while the rest of cases failed (12.50%). As regards the control group 11 out of 16 cases (68.80%) were successful while the rest of cases failed (31.20%) as shown in **Table (7) & Figures (4), (5), (6), (7)**.

Intra-group comparison:

For both groups, there was no statistically significant difference between values measured at different follow-up intervals (p>0.05) as shown in **Table (7)**.

Follow-up	Secondary caries		Intervention	Control	*p*-value
3 months	Success	n	12	10	0.703ns
		%	75.00%	62.50%	
	Failure	n	4	6	
		%	25.00%	37.50%	
6 months	Success	n	11	12	1ns
		%	68.80%	75.00%	
	Failure	n	5	4	
		%	31.20%	25.00%	
9 months	Success	n	14	11	0.392ns
		%	87.50%	68.80%	
	Failure	n	2	5	
		%	12.50%	31.20%	
p-value			0.483ns	0.748ns	

*; significant ($p \leq 0.05$) ns; non-significant (p>0.05)

Table (7): Frequencies (n) and percentages (%) of Secondary Caries in both groups according to clinical evaluation

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7. Restoration Color Stability:

Inter-group Comparison:

For all follow-up intervals, the difference between both groups was not statistically significant (p>0.05). After 3 months, 7 out 16 cases (43.80%) in the intervention group were successful while the rest of cases failed (56.20%). As regards the control group 8 out of 16 cases (50.00%) were successful while the rest of cases failed (50.00%).

After 6 months follow up, 5 out of 16 cases (31.20%) in the intervention group were successful while the rest of cases failed (68.80%). Regarding the control group, 10 out of 16 cases (62.50%) were successful while the rest of cases failed (37.50%).

After 9 months follow up, 6 out 16 cases (37.50%) in the intervention group were successful while the rest of cases failed (62.50%). As regards the control group 9 out of 16 cases (56.20%) were successful while the rest of cases failed (43.80%) as shown in **Table (8) & Figures (4), (5), (6), (7)**.

Intra-group Comparison:

For both groups, there was no statistically significant difference between values measured at different follow-up intervals (p>0.05) as shown in **Table (8)**.

Follow-up	Restoration color stability		Intervention	Control	*p*-value
3 months	Success	n	7	8	1ns
		%	43.80%	50.00%	
	Failure	n	9	8	
		%	56.20%	50.00%	
6 months	Success	n	5	10	0.330ns
		%	31.20%	62.50%	
	Failure	n	11	6	
		%	68.80%	37.50%	
9 months	Success	n	6	9	1ns
		%	37.50%	56.20%	
	Failure	n	10	7	
		%	62.50%	43.80%	
p-value			0.766ns	0.766ns	

*; significant ($p \leq 0.05$) ns; non-significant (p>0.05)

Table (8): Frequencies (n) and percentages (%) of Restoration Color Stability in both groups according to clinical evaluation

8. Gingival inflammation:

Gingival inflammation in the USPHS criteria was not given a score since it was not considered applicable in this study as all cases were class I cavity restorations with no gingival involvement.

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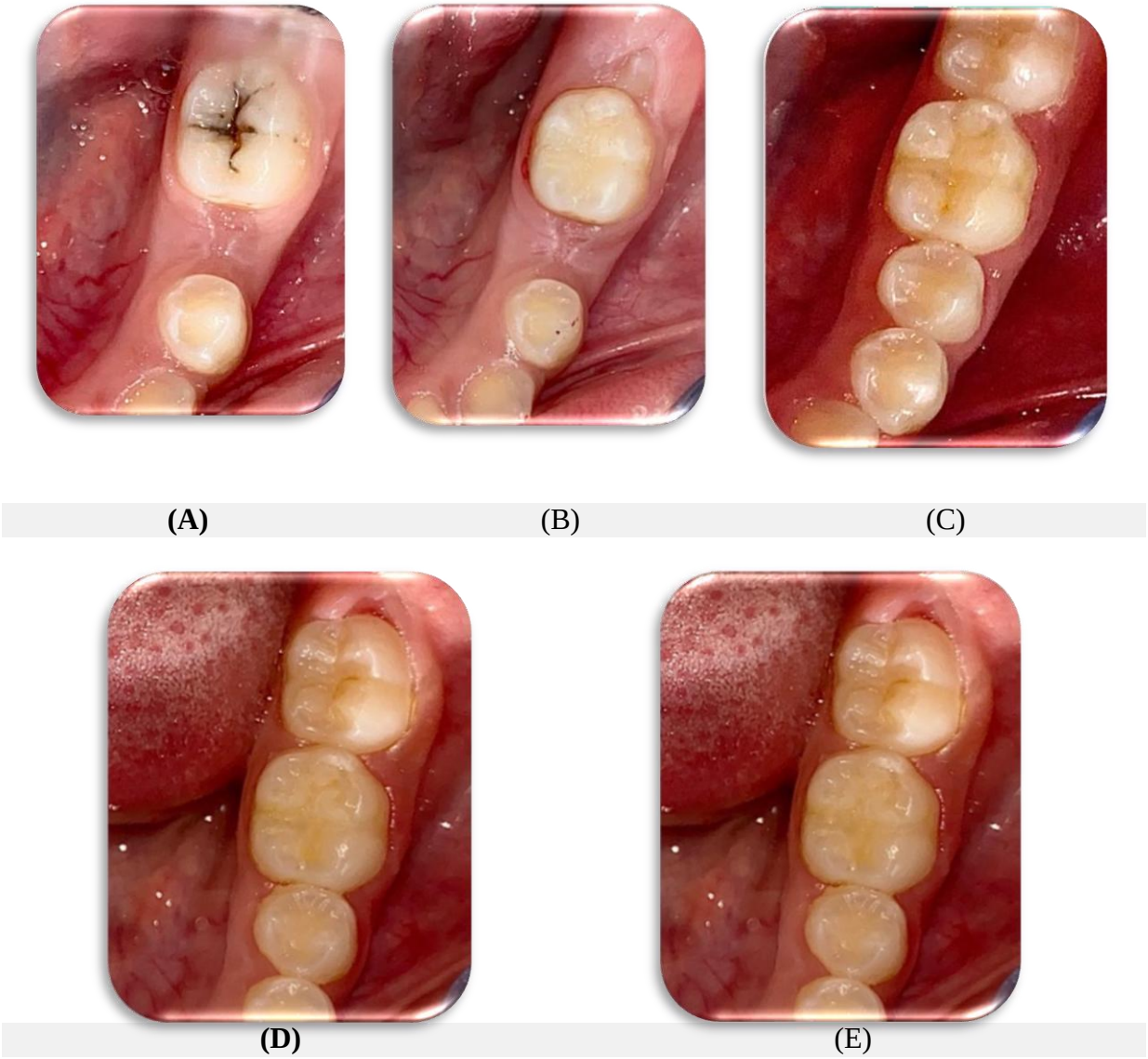

Figure (4): A photograph showing a lower left first permanent molar for a successful intervention: (A) A pre-operative photo (B) Immediate post-operative (C) 3 months follow-up (D) 6 months follow-up (E) 9 months follow-up

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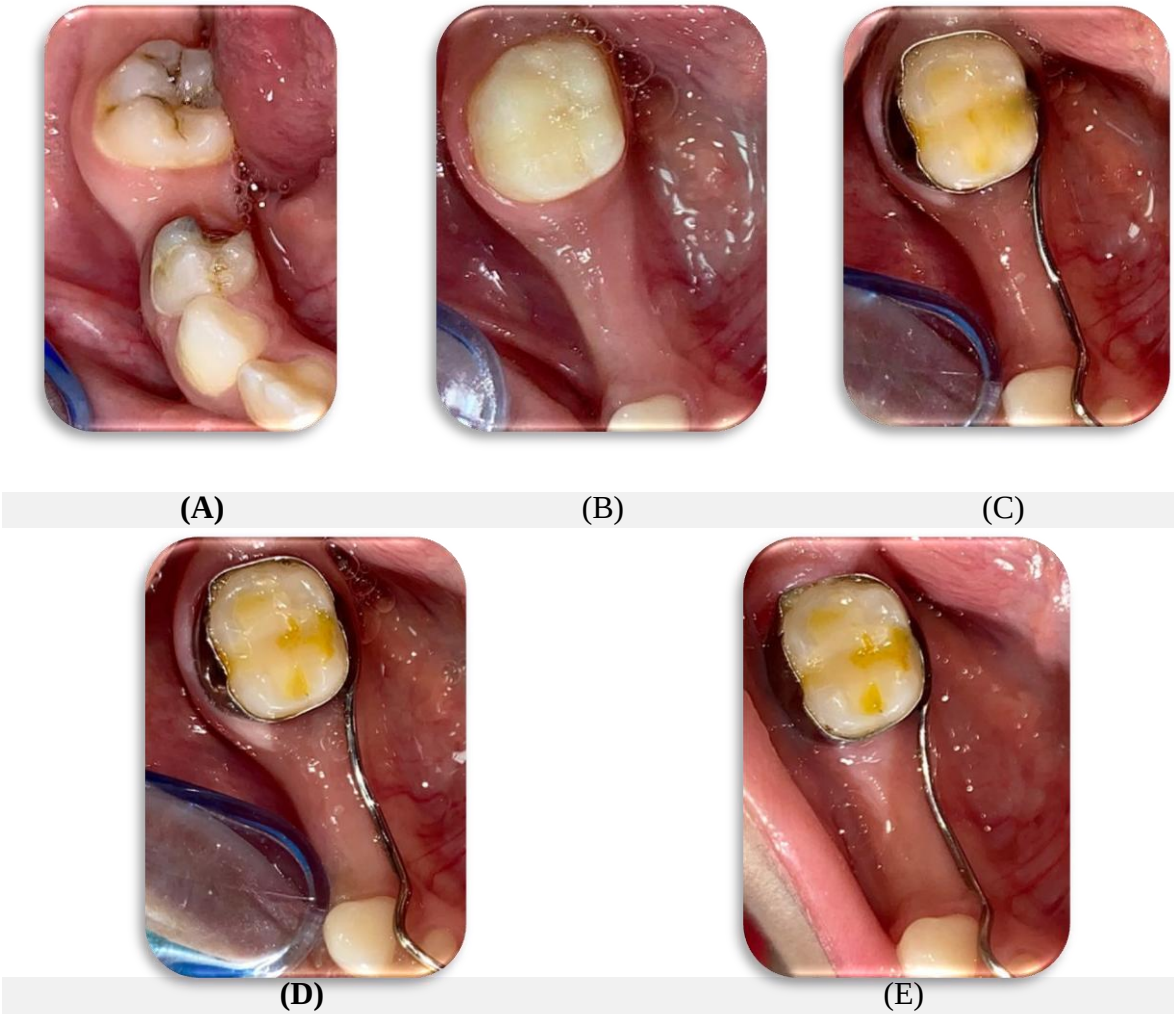

Figure (5): A photograph showing a lower right first permanent molar for a failure intervention: (A) A pre-operative photo (B) Immediate post-operative (C) 3 months follow-up (failure in tooth and restoration color stability, surface texture and marginal discoloration (enamel)) (D) 6 months follow-up (failure in tooth and restoration color stability, surface texture and marginal discoloration (enamel)) (E) 9 months follow-up (failure in tooth and restoration color stability, marginal discoloration(enamel), anatomical form and marginal integrity (enamel))

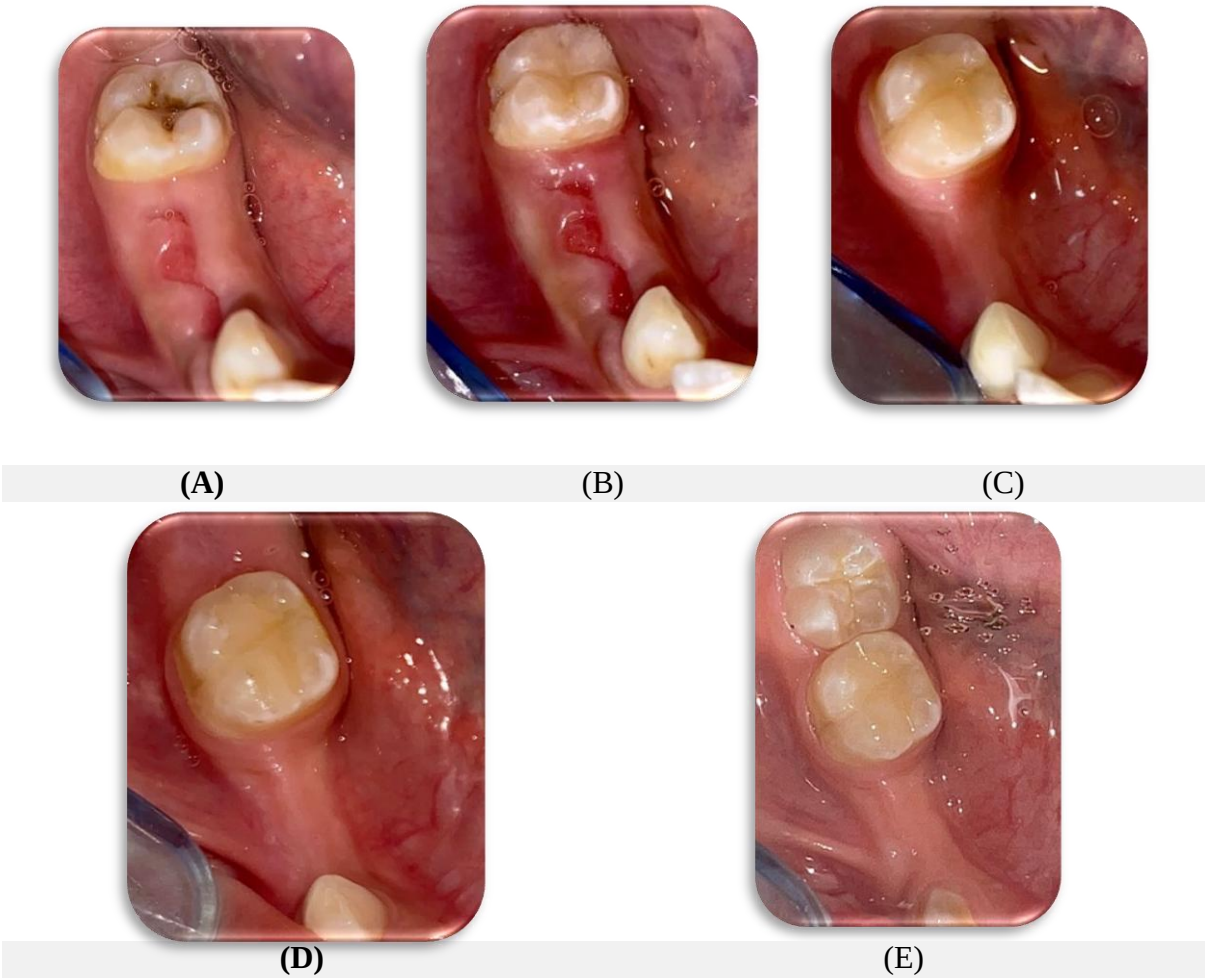

Figure (6): A photograph showing a lower right first permanent molar for a successful control: (A) A pre-operative photo (B) Immediate post-operative (C) 3 months follow-up (D) 6 months follow-up (E) 9 months follow-up

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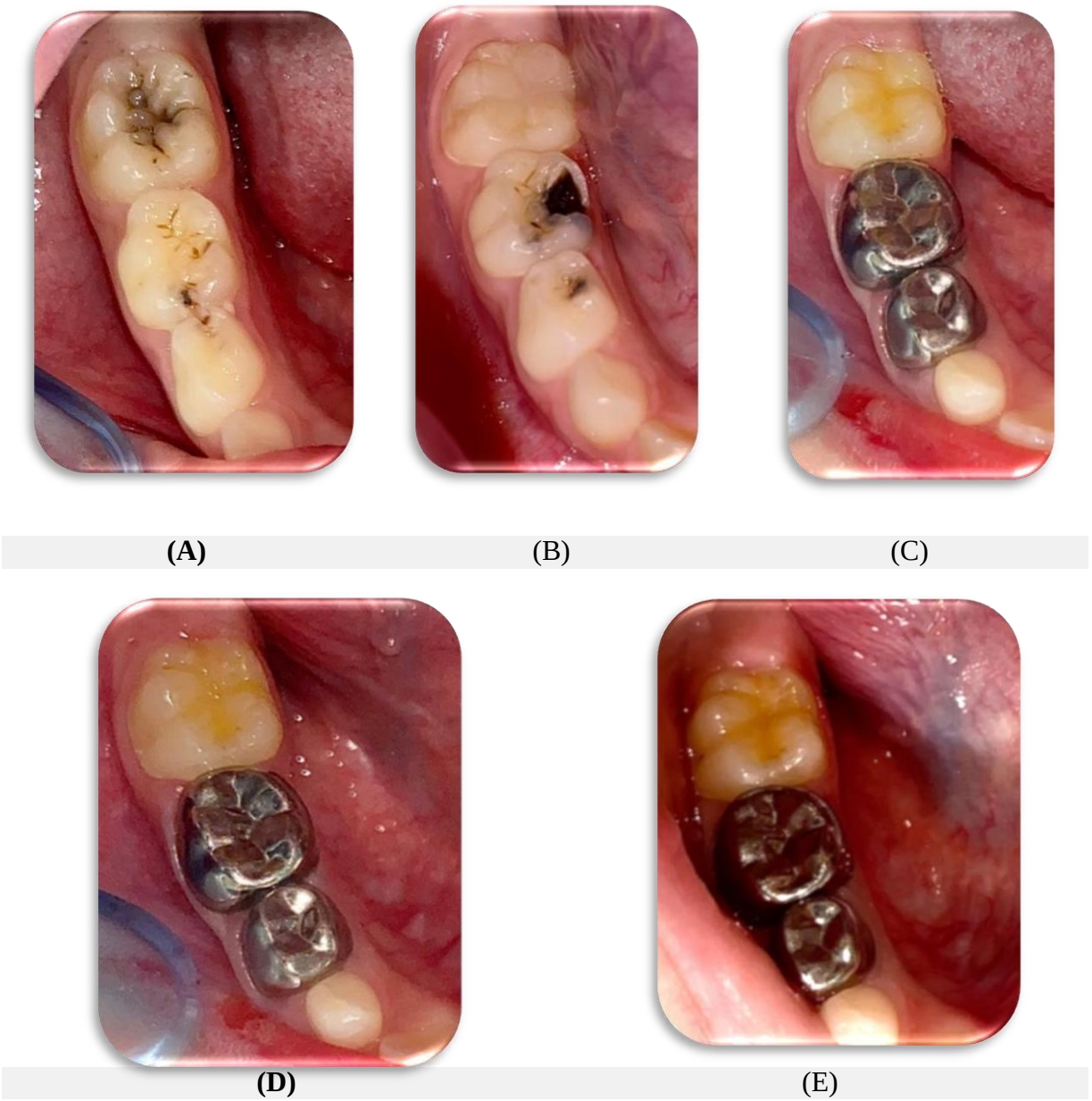

Figure (7): A photograph showing a lower right first permanent molar for a failure control: (A) A pre-operative photo (B) Immediate post-operative (C) 3 months follow-up (failure in tooth and restoration color stability) (D) 6 months follow-up (failure in tooth and restoration color stability and marginal discoloration(enamel)) (E) 9 months follow-up (failure in secondary caries, marginal integrity (enamel), tooth and restoration color stability and marginal discoloration (enamel))

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DISCUSSION

This study was conducted to assess postoperative pain following composite resin restoration against sonic fill among children having deep carious first permanent molars. There is a gap of knowledge related to clinical success of sonic fill, although the mechanical and physical qualities of sonic-resin placement methods have indicated comparable or superior performance compared to conventional composite resins placed progressively.[10,14,18]

In this study postoperative pain was assessed as early as at baseline (24 hours) and one week according to Sabbagh et al[17] indicating that composite resin induces many stresses following polymerization, in addition to later follow ups at one, three, six, and nine months, which took place for possible marginal defects.

From baseline (24 hours) until 3 months, 85% of the intervention and 85% of the control groups respectively had no pain, and the difference between the two groups was not statistically significant from baseline to the end of the follow-up period as shown in **Table (1)**. This indicates that both techniques were nearly similar in the amount of stress induced during polymerization shrinkage. Typically, the vibrational motion of the sonic fill system increases the flow of the restoration and increases its adaptation. This correlates directly with the findings of Ayar[4] who discovered that postoperative sensitivity reported by patients after restoration placement was not influenced by the resin composite technique of application when comparing incremental, bulk-fill resin composite and sonic fill.

Our results also agreed with van Dijken & Pallesen[17] findings, who evaluated the therapeutic efficacy of the flowable bulk-fill composite technique versus the incremental composite technique in posterior restorations. There was no difference in the incidence of postoperative sensitivity following restoration placement between groups. Moreover, our 9-month follow up also confirmed the findings of Atabek et al[3] who observed that neither group exhibited postoperative sensitivity during their 2-year follow-up period. This study, however, contradicts the findings of Hickey et al[13] who reported postoperative sensitivity associated with bulk-fill composites, which gradually decreased by time.

As regards the USPHS Criteria, the anatomical form was similar presenting alpha in different follow up periods with both restorations. This was similar to Gianordoli-Neto.[12]

Marginal integrity (enamel) and surface roughness presented with a score of alpha and gradually decreased to bravo at similar periods for both groups. This result coincided with Atabek et al[3], who examined the 2-year clinical outcomes of two restorative procedures for posterior permanent carious molars (conventional posterior composite with incremental packing and sonic-resin filling system).

At the end of the follow up period, none of the restorations in sonic fill group showed marginal discoloration (enamel), while slight discoloration was observed in the composite group without any statistical significance between them. This finding was in accordance with

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Yazici[20] who found that for all USPHS parameters, no statistically significant differences were seen between sonic-fill and composite resin restorations.

At 6 and 9 months follow-up, the alpha score was reduced to bravo for enamel marginal discoloration and integrity, as well as surface texture and both restoration and tooth color stability. At comparable intervals, remarkable changes in marginal staining and surface roughness were seen for both groups. This result coincided with Atabek et al[3] who found that after 1 year, surface roughness and marginal adaptation evaluations for composite resins generated bravo scores.

In the present study, secondary caries presented an alpha and bravo score in both groups. Comparable results were published by Bayraktar et al[5] who noticed secondary caries starting with a very small degree of marginal discoloration within one year in the traditional over the bulk-fill resins and attributed their findings to improper marginal adaptation leading to adhesive deterioration over time.

According to the secondary caries both groups were nearly similar at different follow up periods in accordance to success and failure. Costo[9] reported that any gap in the tooth restoration interface may contribute to biofilm retention and, on the long run, marginal infiltration, dental sensitivity and secondary caries may develop.

The surface texture and marginal integrity (enamel) in the intervention group was similar to the control group presenting with alpha score at 3 months and gradually decreasing to bravo score at 9 months follow-up. This matched the findings of Gianordoli-Neto[12] who found that the only criterion that presented a distinct value with no statistical difference was marginal integrity.

CONCLUSION

The study concludes that both restorative materials could be used with children with deep carious lesions. Sonic-resin placement system is a suitable alternative for posterior class 1 composite restorations as it saves time.

There was no postoperative pain in the majority of cases in both groups and the difference between the two groups was not statistically significant from baseline to the end of the follow-up period.

As regards the USPHS Criteria, marginal discoloration (enamel) and anatomical form seem similar presenting alpha in different follow up periods in both restorations.

Regarding the secondary caries both groups were nearly similar at different follow up periods. The surface texture and marginal integrity (enamel) in the intervention group was similar to the control group presented with alpha score gradually decreasing to bravo score. Regarding the tooth and restorative color stability composite was superior to sonic fill.

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Declaration of Interest

No known conflict of interests.

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