How to Cite:
Mohamed, A. R., Elmohsen, M. M. A., Abi-Elhassan, M. H., Haridy, M. F., & Raafat, R. (2022). Clinical evaluation of direct resin composite restorations of endodontically treated molars using dual cured self-adhesive system with bulk fill composite versus incremental packing technique: Randomized control trial. *International Journal of Health Sciences*, *6*(S1), 3263–3288.
https://doi.org/10.53730/ijhs.v6nS1.5468

Clinical Evaluation of Direct Resin Composite Restorations of Endodontically Treated Molars using Dual Cured Self-Adhesive System with Bulk Fill Composite Versus Incremental Packing Technique: Randomized Control Trial

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***Abstract*---**Restoration after endodontic treatment is as important as root canal therapy for clinical success. Evolution of adhesive dentistry strongly aided in the conservation of tooth structure and reinforcement of the restored teeth. Self-etch adhesives has evolved aiming to reduce the technique sensitivity and simplifying the steps needed for bonding (one or two steps). Dual cured self-etch adhesives were also introduced to be more chemically compatible with the resin composite restorations. Bulk-fill resin composites has also achieved great popularity due to the ease of application and being more time saving. These materials made the direct restoration of endodontically treated teeth more conservative, time saving and reliable. This

International Journal of Health Sciences ISSN 2550-6978 E-ISSN 2550-696X © 2022.
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Manuscript submitted: 18 Jan 2022, Manuscript revised: 09 Feb 2022, Accepted for publication: 27 March 2022

research was performed to assess the clinical success of the restorations of the endodontically treated molars with remaining three walls restored using self-etch adhesives and bulk fill resin composite in comparison to conventional nanohybrid resin composite at a time intervals of 1week (baseline), 3, 6 and 12 months. In a randomized clinical trial, 40 patients with endodontically treated molars with remaining three walls received a restorative intervention with either (Xtra-Fil) bulk fill resin composite or (Grandio) nano hybrid resin composite applied in incremental technique. The adhesive strategy was total etching for Enamel and Dentin and dual cure self-etch adhesive (Futurabond DC). All materials were applied according to manufacturers' instructions. Restorations were assessed at 1 week (baseline), 3, 6 and 12 months by two blinded assessors using modified USPHS criteria measuring (retention, marginal adaptation, marginal discoloration, color match, surface texture, secondary caries and anatomic form). Categorical data were presented as Frequencies (n) and Percentages (%). Fisher's exact test and tests of marginal homogeneity have been used to evaluate intergroup and intragroup comparisons, respectively. For all tests, the significance level was set at $P \leq 0.05$. At baseline (1 week), 3, 6 and 12 months, there was no statistically significant difference between both materials for all tested outcomes except for color match at 6 months follow up and the marginal adaptation at 12 months follow up.

***Keywords*---**resin composite restorations, treated molars, bulk fill composite, packing technique.

Introduction

Endodontic therapy is preserving many teeth which otherwise would be considered hopelessly deteriorated (Rosen H, 1961). Although, in a very broad epidemiological survey, the long-term functional survival of initial endodontically treated permanent teeth was recorded as 97.1% after 8 years, significant reasons for post-endodontic tooth repairs and extractions continue to be coronal and/or radicular tooth fractures (Tang W et al, 2010). The main reason for fracture of endodontically treated teeth is the loss of tooth material during the removal of caries and the preparation of endodontic access cavities. The fracture resistance of endodontically treated teeth is negatively affected by the removal of the marginal walls, particularly in the occlusal areas during preparation. Fracture resistance (Yıkılgan I et al, 2013) is also adversely affected by dehydration, collagen cruciate ligament loss, and dentin loss following endodontic treatment.

After endodontic treatment, restoration is as important as root canal treatment for clinical success. For up to 25 years, a major retrospective study found that the success rate for single teeth with endodontic-treated artificial crowns was 94.8% and 75.8% without artificial crowns were substantially lower. Another retrospective research concluded that the rate of survival was greater than resin composite (77.0 %) against fracture of endodontically treated teeth restored with crowns (95.1%). Endodontically treated teeth restored with resin composite had a

high survival rate of 88.5 % with 1 or 2 tooth surface losses, which was not substantially different from teeth with crowns. In teeth repaired with composite resin, a higher rate of restorability after fracture was found than in crowns. Potential risk factors related to fracture were defined as the type of restoration and number of proximal contacts (Suksaphar W et al, 2018). Evolution of adhesive dentistry strongly aided in the conservation of tooth structure and reinforcement of the restored teeth. Self-etch adhesives has evolved aiming to reduce the technique sensitivity and simplifying the steps needed for bonding (one or two steps) (Yousaf A et al, 2014). Dual cured self-etch adhesives were introduced to decrease the amount of the residual monomer which will improve the bond strength and the marginal integrity of composite restorations rather than light cured adhesives.

More recently, some studies found that simplified adhesives may be chemically incompatible with resin composites (Sunada N. et al 2013). Residual acidic monomers in the oxygen-inhibited underlying layer produced by simplified pH < 3 adhesive systems deactivate the initiator component (aromatic tertiary amine) inhibiting resin composite polymerization reactions resulting in weak polymerization. In order to avoid the possible incompatibility among simplified adhesives and resin composites and to achieve full polymerization in deeper parts of the preparation, such as preparations for access cavities, actually, certain simplified light-curing adhesives are combined with a self-curing activator, typically made up of arylsulfinate salts (Nunes TG et al 2009). In 2000, when self-cured buildup resin composites were bonded with simplified adhesive systems, bonding failures were recorded. It was proposed that this phenomenon could be correlated with the chemistry of the adhesive, specifically a low pH. Some invitro studies also found that the addition of chemical activator to the adhesive influenced the shear bond strength and the nano leakage but this influence was material dependant (Gutierrez MF et al, 2017).

Bulk-fill resin composites has also achieved great popularity due to the ease of application and more time saving. A research was performed to assess the marginal quality of bulk-fill composite which was found similar to that of incremental packing of the resin composites. (Heintze SD et al, 2015).

Because of improvements in their optical, mechanical and physical properties and ease of clinical handling, tooth-colored restorative resins are the most preferred restorations. Recently, various fillers and monomer systems have been updated or added to restorative substances for the therapeutic efficacy of restorations. From macro-filled composites, micro-filled composites, hybrid composites, micro-hybrid composites, and flowable composites, restorative resins are altered from past to present to recent nano composites. Through the introduction of newer resin formulations and filler concentration, developments are mainly intended to reduce polymerization shrinkage and growing stiffness, compressive strength, flexural strength, and flexural modulus (Beun S et al, 2007). Compared to traditional resins, Nano composites thus respond much better to the functional stresses of mastication. Mechanical and physical properties such as high strength, fracture toughness, surface stiffness, optimized elasticity modulus, low wear, low water absorption and solubility must be checked for restorative materials used in stress-bearing areas.

Therefore, the investigation in the present research was aimed to assess the clinical success of direct composite restorations endodontically treated molars with remaining three walls either by bulk fill or incremental technique with dual cured self-etch adhesive system at one week (baseline), 3, 6 and 12 months follow up periods according to the modified USPHS criteria. The null hypothesis of this study is that teeth restored with bulk fill technique composite can perform successfully as teeth restored with incremental packing technique. This is considered as a more conservative method than the traditional method of covering the whole tooth stump or even the occlusal surface using overlays or endo-crowns.

Materials and Methods

Materials:

The following materials were used in this study:

I.1.a - Bulk fill resin composite of universal shade (intervention)

Light-cured, highly radio-opaque resin composite with 75% w/w filler content designed for posterior region for restoration of large cavities to reduce the working time with an increment up to 4mm thickness and 10 seconds curing time according to the manufacturer's instructions.

I.1.b- Universal nano hybrid resin composite shades A2 and A3(comparator)

Light cured nanohybrid resin composite for anterior and posterior region, comes in 16 different shades with significantly low polymerization shrinkage of 1.6 % with 87% w/w filler content and high wear resistance.

I.1.c - Bulk fill flowable resin composite: (base material)

A highly radio opaque flowable light cured base composite with 75% filler loading and polymerization shrinkage of 2.6% that can be cured only in 10 seconds in a bulk of 4mm with excellent surface affinity and adaptation. This resin composite was applied at the base of the cavity to standardize a distance of 4mm from the base to the cavity to the surface.

I.2 - Adhesive system

A dual cure self-etch adhesive reinforced with nano fillers in the form of single dose blisters that consist of 2 liquids to be mixed in equal portions for 2 seconds till we get a homogenous mix and it is rubbed on the surface for 20 seconds and then cured for 10 seconds in compliance with the instructions of the manufacturer. All the restorations in the present study was bonded with this adhesive system to standardize the bonding protocol.

Methods

II.1. Study setting:

The protocol of the current study was registered in (www.Pactr.org) **Pan African Clinical Trial Registry** database under unique identification number **PACTR201602001466307.** The ethical standards of the Research Ethics Committee of the Faculty of Dentistry, Cairo University (CREC) is compatible with all procedures carried out in this study involving human participants. This randomized controlled clinical study was held in Faculty of Dentistry, Cairo University, Egypt.

Sample size calculation

The purpose of this research was to assess the Clinical success of restoration bulk fill resin composite and incremental packing of resin composite An equivalence trial will be conducted if there is really no difference among the standard and the experimental therapy, then it is appropriate to restore 16 to be 80% sure that the limits of a two-sided 90 % confidence interval would exclude a difference of more than 15% among the standard and the experimental group. This number is to be increased to 20 to compensate for losses during follow up **(Julious SA.** Estimating Samples Sizes in Clinical Trials. CRC; 2009).

Statistical analysis

Categorical data were presented as Frequencies (n) and Percentages (%). Fisher's exact test and tests of marginal homogeneity were used to analyze inter and intragroup comparisons respectively. For all tests, the significance level was set at $P \leq 0.05$. With IBM ® SPSS ® (SPSS Inc., IBM Corporation, NY, USA) Statistics Version 25 for Windows, statistical analysis was conducted.

Results

I-Inter-rater reliability:
Weighted Kappa (κ_w) with linear weights, showed a very good agreement between the two examiners (κ_w=0.85) (85%) which was statistically significant. (P<0.001).
II- Color match:
Frequencies (n) and Percentages (%) of color match scores in both groups were presented in table (1) and figures (38,39,40)

1- Inter-group comparison:
At baseline evaluation, out of 40 restorations, all the 20 restorations with incremental technique had a score 0 with a percentage of 100 % color match with the tooth structure while in case of bulk fill technique, 17 restorations had a score 0 and 3 restorations had a score 1 with a percentage of 85 % color match and 15 % slight acceptable mismatch. There was no substantial difference in color match scores among both groups (P=0.231).
At 3 months evaluation, for the incremental group, 17 restorations had a score 0 and 3 restorations had a score 1 with a percentage of 85% color match. While for the bulk fill group, 12 restorations had a score 0 and 8 restorations had a score 1 with a percentage of 60 % color match. There was no substantial difference in color match scores among both groups (P=0.155).
At 6 months evaluation, for the incremental group, 17 restorations had a score 0 and 3 restorations had a score 1 with a percentage of 85% color match while for the bulk fill group, 10 restorations had a score 0 and 10 restorations had a score 1 with a percentage of 50% color match There was a substantial difference in color match scores among both groups (P=0.041).
At 12 months evaluation, for the incremental group, 6 restorations had a score 0 and 14 restorations had a score 1 with a percentage of 30% color match while for the bulk fill group, 6 restorations had a score 0 and 14 restorations had a score 1 with a percentage of 30% color match There was no significant difference in color match scores between both groups (P=1.000).

2- **Intra-group comparison:**

For the Bulk fill group, no significant difference between the distribution of the scores between different follow-up intervals (P=0.112). At baseline majority of restorations (85%) had a score of (0) and a lower percentage (15%) had a score of (1). After 3 months, percentage of score (0) dropped to (60%), while the percentages of score (1) increased to (40%). Decrease of score (0) percentage continued to be (50%) after 6 months and (30%) by 12 months. While score (1) percentage continued to increase to be (50%) at 6 months and (70%) by 12 months.

For the Incremental group, no significant difference between the distribution of the scores between different follow-up intervals (P=0.261). At baseline all restorations were given a score of (0). After 3 months percentage of score(0) decreased to be (85%) while the percentage of score (1) was (15%). After 6 months both scores remained unchanged, but after 12 months, percentage of score (0) dropped to (30%) while the percentage of score (1) increased to (70%).

Table (1): Frequencies (n) and Percentages (%) of color match scores in both groups.

Follow-up	Color match		Bulk-fill	Incremental	P-value
Baseline	Score (0)	n	17	20	0.231ns
		%	85.0%	100.0%	
	Score (1)	n	3	0	
		%	15.0%	0.0%	
	Score (2)	n	0	0	
		%	0%	0%	
3 months	Score (0)	n	12	17	0.155ns
		%	60.0%	85.0%	
	Score (1)	n	8	3	
		%	40.0%	15.0%	
	Score (2)	n	0	0	
		%	0%	0%	
6 months	Score (0)	n	10	17	0.041*
		%	50.0%	85.0%	
	Score (1)	n	10	3	
		%	50.0%	15.0%	
	Score (2)	n	0	0	
		%	0%	0%	
12 months	Score (0)	n	6	6	1.000ns
		%	30.0%	30.0%	
	Score (1)	n	14	14	
		%	70.0%	70.0%	
	Score (2)	n	0	0	
		%	0%	0%	
P-value			0.112ns	0.261ns	

*; significant (p ≤ 0.05) ns; non-significant (p>0.05).

III- Marginal discoloration:
Frequencies (n) and Percentages (%) of marginal discoloration scores in both groups were presented in table (2) and figures from (41,42,43).

1- Inter-group comparison:
At baseline evaluation, out of 40 restorations, all the 20 restorations with incremental technique had a score 0 with a percentage of 100% of no marginal discoloration with the tooth structure while in case of bulk fill technique , 20 restorations had a score 0 with a percentage of 100 % of no marginal discoloration.
At 3 months evaluation, for the incremental group, 18 restorations had a score 0 and 2 restorations had a score 1 with a percentage of 10% marginal discoloration while in case of bulk fill technique, 19 restorations had a score 0 and 1 restorations had a score 1 with a percentage of 5 % marginal discoloration . No significant difference in marginal discoloration scores among both groups (P=1.000).
At 6 months evaluation, for the incremental group, 10 restorations had a score 0 and 10 restorations had a score 1 with a percentage of 50% marginal discoloration while in case of bulk fill technique, 11 restorations had a score 0 and 9 restorations had a score 1 with a percentage of 45 % marginal discoloration . No significant difference in marginal discoloration scores among both groups (P=1.000).
At 12 months evaluation , for the incremental group, only 4 restorations had a score 0 and 16 restorations had a score 1 with a percentage of 80% marginal discoloration while in case of bulk fill technique , 6 restorations had a score 0 and 14restorations had a score 1 with a percentage of 70 % marginal discoloration. No significant difference in marginal discoloration scores among both groups (P=0.716).

2- Intra-group comparison:
For bulk-fill group, no significant difference between the distribution of the scores between different follow-up intervals (P=0.250). At baseline all the restorations (100%) had a score of (0). After 3 months, percentage of score (0) dropped to (95%), while the percentages of score (1) increased to (5%). Decrease of score (0) percentage continued to be (55%) after 6 months and (30%) by 12 months. While score (1) percentage continued to increase to be (45%) at 6 months and (70%) by 12 months.
For incremental group, no significant difference between the distribution of the scores between different follow-up intervals (P=0.112). At baseline all restorations were given a score of (0). After 3 months percentage of score (0) decreased to be (90%) while the percentage of score (1) was (10%). Decrease of score (0) percentage continued to be (50%) after 6 months and (20%) by 12 months. While score (1) percentage continued to increase to be (50%) at 6 months and (80%) by 12 months.

Table (2): Frequencies (n) and Percentages (%) of marginal discoloration scores in both groups.

Follow-up	Marginal discoloration		Bulk-fill	Incremental	P-value
Baseline	Score (0)	n	20	20	———
		%	100.0%	100.0%	
	Score (1)	n	0	0	
		%	0%	0%	
	Score (2)	n	0	0	
		%	0%	0%	
3 months	Score (0)	n	19	18	1.000ns
		%	95.0%	90.0%	
	Score (1)	n	1	2	
		%	5.0%	10.0%	
	Score (2)	n	0	0	
		%	0%	0%	
Follow-up	**Marginal discoloration**		**Bulk-fill**	**Incremental**	**P-value**
6 months	Score (0)	n	11	10	1.000ns
		%	55.0%	50.0%	
	Score (1)	n	9	10	
		%	45.0%	50.0%	
	Score (2)	n	0	0	
		%	0%	0%	
12 months	Score (0)	n	6	4	0.716ns
		%	30.0%	20.0%	
	Score (1)	n	14	16	
		%	70.0%	80.0%	
	Score (2)	n	0	0	
		%	0%	0%	
P-value			0.250ns	0.112ns	

*; significant (p ≤ 0.05) ns; non-significant (p>0.05).

III- Marginal adaptation:

Frequencies (n) and Percentages (%) of marginal adaptation scores in both groups were presented in table (3) and figures from (44,45,46).

1- Inter-group comparison:

At baseline and 3 months evaluation, out of 40 restorations ,all the 20 restorations with incremental technique had a score 0 with a percentage of 100% marginal adaptation with the tooth structure while in case of bulk fill technique ,also all the 20 restorations had a score 0 with a percentage of 100 % marginal adaptation.

At 6 months evaluation, for the incremental group, 19 restorations had a score 0 and 1 restorations had a score 1 with a percentage of 95% marginal adaptation while in case of bulk fill technique, 17 restorations had a score 0 and 3 restorations had a score 1 with a percentage of 85 % marginal adaptation , no significant difference in marginal adaptation scores among both groups (P=0.605).
At 12 months evaluation, for the incremental group, 17 restorations had a score 0 and 3 restorations had a score 1 with a percentage of 85% marginal adaptation while in case of bulk fill technique, 10 restorations had a score 0 and 10 restorations had a score 1 with a percentage of 50 % marginal adaptation. A significant difference in marginal adaptation scores among both groups (P=0.020).

2- **Intra-group comparison:**
For bulk-fill group, no significant difference between the distribution of the scores between different follow-up intervals (P=0.500). At baseline and 3 months all the restorations (100%) had a score of (0). After 6 months, percentage of score (0) dropped to (85%), while the percentages of score (1) increased to (15%). After 12 months, decrease of score (0) percentage continued to be (50%), while score (1) percentage continued to increase to be (50%) as well.
For incremental group, no significant difference between the distribution of the scores between different follow-up intervals (P=0.170). At baseline and 3 months all the restorations (100%) had a score of (0). After 6 months, percentage of score (0) dropped to (95%), while the percentages of score (1) increased to (5%). After 12 months, decrease of score (0) percentage continued to be (85%), while score (1) percentage continued to increase to be (15%).

Table (3): Frequencies (n) and Percentages (%) of marginal adaptation scores in both groups.

Follow-up	Marginal adaptation		Bulk-fill	Incremental	P-value
Baseline	Score (0)	n	20	20	———
		%	100.0%	100.0%	
	Score (1)	n	0	0	
		%	0%	0%	
	Score (2)	n	0	0	
		%	0%	0%	
	Score (3)	n	0	0	
		%	0%	0%	
3 months	Score (0)	n	20	20	———
		%	100.0%	100.0%	
	Score (1)	n	0	0	
		%	0%	0%	
	Score (2)	n	0	0	
		%	0%	0%	
	Score (3)	n	0	0	
Follow-up	Marginal adaptation		Bulk-fill	Incremental	P-value
		%	0%	0%	
		n	17	19	

6 months	**Score (0)**	**%**	85.0%	95.0%	**0.605ns**
	Score (1)	**n**	3	1	
		%	15.0%	5.0%	
	Score (2)	**n**	0	0	
		%	0%	0%	
	Score (3)	**n**	0	0	
		%	0%	0%	
12 months	**Score (0)**	**n**	10	17	**0.020***
		%	50.0%	85.0%	
	Score (1)	**n**	10	3	
		%	50.0%	15.0%	
	Score (2)	**n**	0	0	
		%	0%	0%	
	Score (3)	**n**	0	0	
Follow-up	**Marginal adaptation**		**Bulk-fill**	**Incremental**	**P-value**
		%	0%	0%	
P-value			**0.500ns**	**0.170ns**	

*; significant (p ≤ 0.05) ns; non-significant (p>0.05).

IV- Anatomic form:

Frequencies (n) and Percentages (%) of anatomic form scores in both groups were presented in table (4) and figures (47,48,49).

1- Inter-group comparison:

At baseline and 3 months evaluation, out of 40 restorations ,all the 20 restorations with incremental technique had a score 0 with a percentage of 100% continuous anatomic form with the tooth structure while in case of bulk fill technique, also all the 20 restorations had a score 0 with a percentage of 100 % continuous anatomic form.

At 6 months evaluation, for the incremental group, 19 restorations had a score 0 and 1 restorations had a score 1 with a percentage of 5% slight anatomic form discontinuity, while in case of bulk fill technique, 15 restorations had a score 0 and 5 restorations had a score 1 with a percentage of 25 % slight anatomic form discontinuity. No significant difference in anatomic form scores among both groups (P=0.182).

At 12 months evaluation, for the incremental group, 11 restorations had a score 0 and 8 restorations had a score 1 with a percentage of 40% slight anatomic form discontinuity and 1 restoration had a score 2 with a percentage of 5% surface discontinuity and failure, while in case of bulk fill technique, 13 restorations had a score 0 and 7 restorations had a score 1 with a percentage of 35 % slight anatomic form discontinuity. No significant difference in anatomic form scores among both groups (P=0.445).

2- Intra-group comparison:

For bulk-fill group, no significant difference between the distribution of the scores between different follow-up intervals (P=0.194). At baseline and 3 months all the restorations (100%) had a score of (0). After 6 months, percentage of score

(0) dropped to (75%), while the percentages of score (1) increased to (25%). After 12 months, decrease of score (0) percentage continued to be (65%), while score (1) percentage continued to increase to be (35%).

For incremental group, no significant difference between the distribution of the scores between different follow-up intervals (P=0.210). At baseline and 3 months all the restorations (100%) had a score of (0). After 6 months, percentage of score (0) dropped to (95%), while the percentages of score (1) increased to (5%). After 12 months, decrease of score (0) percentage continued to be (55%), while score (1) percentage continued to increase to be (15%) while only (5%) of restoration developed score (2).

Table (4): Frequencies (n) and Percentages (%) of anatomic form scores in both groups.

Follow-up	Anatomic form		Bulk-fill	Incremental	P-value
Baseline	Score (0)	n	20	20	———
		%	100.0%	100.0%	
	Score (1)	n	0	0	
		%	0%	0%	
	Score (2)	n	0	0	
		%	0%	0%	
3 months	Score (0)	n	20	20	———
		%	100.0%	100.0%	
	Score (1)	n	0	0	
		%	0%	0%	
	Score (2)	n	0	0	
		%	0%	0%	
6 months	Score (0)	n	15	19	0.182ns
		%	75.0%	95.0%	
	Score (1)	n	5	1	
		%	25.0%	5.0%	
	Score (2)	n	0	0	
		%	0%	0%	
12 months	Score (0)	n	13	11	0.445ns
		%	65.0%	55.0%	
	Score (1)	n	7	8	
		%	35.0%	40.0%	
	Score (2)	n	0	1	
		%	0.0%	5.0%	
P-value			0.194ns	0.210ns	

*; significant (p ≤ 0.05) ns; non-significant (p>0.05).

IV-Surface texture:

Frequencies (n) and Percentages (%) of surface texture scores in both groups were presented in table (5) and figures (50,51,52).

1- **Inter-group comparison:**

At baseline evaluation, out of 40 restorations, all the 20 restorations with incremental technique had a score 0 with a percentage of 100% smooth surfaces while in case of bulk fill technique, 20 restorations had a score 0 with a percentage of 100 % smooth restoration surfaces.

At 3 months evaluation , for the incremental group, 19 restorations had a score 0 and 1 restorations had a score 1 with a percentage of 5% slightly roughened restoration surface, while in case of bulk fill technique , all the 20 restorations showed a smooth restoration surface with a percentage of 100% .There was no substantial difference in surface texture scores among both groups (P=0.235).

At 6 months evaluation , for the incremental group, 15 restorations had a score 0 and 5 restorations had a score 1 with a percentage of 25% slightly roughened surface texture, while in case of bulk fill technique , 12 restorations had a score 0 and 8 restorations had a score 1 with a percentage of 40% slightly roughened surface texture . There was no substantial difference in surface texture scores among both groups (P=0.310).

At 12 months evaluation , for the incremental group, 5 restorations had a score 0 and 15 restorations had a score 1 with a percentage of 75% slightly roughened surface texture, while in case of bulk fill technique , 7 restorations had a score 0 and 13 restorations had a score 1 with a percentage of 65% slightly roughened surface texture. There was no substantial difference in surface texture scores among both groups (P=0.731).

2- **Intra-group comparison:**

For bulk-fill group, no significant difference between the distribution of the scores between different follow-up intervals (P=0.270). At baseline and 3 months all the restorations (100%) had a score of (0). After 6 months, percentage of score (0) dropped to (60%), while the percentages of score (1) increased to (40%). After 12 months, decrease of score (0) percentage continued to be (35%), while score (1) percentage continued to increase to be (65%).

For incremental group, no significant difference between the distribution of the scores between different follow-up intervals (P=0.115). At baseline all the restorations (100%) had a score of (0). After 3 months, percentage of score (0) dropped to (95%), while the percentages of score (1) increased to (5%).Percentage of score (0) continued to decrease after 6 months (75%) and 12 months (25%) while score (1) percentage continued to increase to (25%) and (75%) at the same intervals respectively.

Table (5): Frequencies (n) and Percentages (%) of surface texture scores in both groups.

Follow-up	Surface texture		Bulk-fill	Incremental	P-value
Baseline	Score (0)	n	20	20	——
		%	100.0%	100.0%	
	Score (1)	n	0	0	
		%	0%	0%	
	Score (2)	n	0	0	
		%	0%	0%	
	Score (3)	n	0	0	
		%	0%	0%	

3 months	Score (0)	n	20	19	0.235ns
		%	100.0%	95.0%	
	Score (1)	n	0	1	
		%	0.0%	5.0%	
	Score (2)	n	0	0	
Follow-up	**Surface texture**		**Bulk-fill**	**Incremental**	**P-value**
		%	0%	0%	
	Score (3)	n	0	0	
		%	0%	0%	
6 months	Score (0)	n	12	15	0.310ns
		%	60.0%	75.0%	
	Score (1)	n	8	5	
		%	40.0%	25.0%	
	Score (2)	n	0	0	
		%	0%	0%	
	Score (3)	n	0	0	
		%	0%	0%	
12 months	Score (0)	n	7	5	0.731ns
		%	35.0%	25.0%	
	Score (1)	n	13	15	
		%	65.0%	75.0%	
	Score (2)	n	0	0	
Follow-up	**Surface texture**		**Bulk-fill**	**Incremental**	**P-value**
		%	0%	0%	
	Score (3)	n	0	0	
		%	0%	0%	
P-value			**0.270ns**	**0.115ns**	

*; significant (p ≤ 0.05) ns; non-significant (p>0.05).

VIII- Retention and secondary caries:

Frequencies (n) and Percentages (%) of retention and secondary caries scores in both groups were presented in table (6) and figure (53).

At Baseline evaluation, out of 40 restorations, all the 20 restorations with incremental technique had a score 0 with a percentage of 100 % retained restorations with no secondary caries, and also in case of bulk fill technique , all the 20 restorations had a score 0 with a percentage of 100 % retained restorations with no secondary caries .

Also at 3 ,6 and 12 months evaluation, all the 20 restorations with incremental technique had a score 0 with a percentage of 100 % retained restorations with no secondary caries, and also in case of bulk fill technique , all the 20 restorations had a score 0 with a percentage of 100 % retained restorations with no secondary caries.

Table (6): Frequencies (n) and Percentages (%) of retention and secondary caries scores in both groups.

Follow-up	Retention		Bulk-fill	Incremental	P-value
Baseline	Score (0)	n	20	20	
		%	100.0%	100.0%	
	Score (1)	n	0	0	———
		%	0%	0%	
3 months	Score (0)	n	20	20	
		%	100.0%	100.0%	
	Score (1)	n	0	0	———
Follow-up	**Retention**		**Bulk-fill**	**Incremental**	**P-value**
		%	0%	0%	
6 months	Score (0)	n	20	20	
		%	100.0%	100.0%	
	Score (1)	n	0	0	———
		%	0%	0%	
12 months	Score (0)	n	20	20	
		%	100.0%	100.0%	
	Score (1)	n	0	0	———
		%	0%	0%	
P-value			———	———	

*; significant (p ≤ 0.05) ns; non-significant (p>0.05).

Discussion

Restoration of endodontically treated teeth (ETT**)** has been a challenging restorative procedure as result of compromised biomechanical properties *(Eraslan O et al, 2011).* Loss of structural integrity results from caries, trauma, endodontic and restorative procedures makes them more vulnerable to fracture (*Reeh ES et al, 1989).* The reduction in the resilience and fracture resistance of the treated teeth is usually correlated with endodontic therapy. In addition, the strength of a tooth is weakened by the depth and design of an endodontic access cavity.

A conservative endodontic cavity will decrease tooth stiffness by about 5 % while an additional occluso-mesial or occluso-distal cavity will reduce the stiffness by 14 – 44 % and about 20-63% in case of MOD cavities resulting in an increased susceptibility to fractures *(Reeh ES et al,1989).* Mandibular first molars were the teeth that failed most frequently, and maxillary third molars were the teeth that failed least frequently. For prosthesis reasons (Olcay et al in 2018), the most popular explanation for the extraction of failed endodontically treated teeth was. The available data in literature regarding the restoration of endodontically treated did not present conclusive evidence to assess the success of full coverage crowns compared to conventional bonded restorations and that the clinical experience play a basic role in the decision making and selection of the most suitable restoration *(McReynolds and Duane B ,2016 and Sequeira-Byron P et al 2015).* Not only this, another literature data concluded that there is a poor recommendation

for indirect restorations to restore endodontic-treated teeth and that is a low quality evidence that indirect restoration can have a higher survival rate than direct restorations in periods up to 10 years *(Xin Shu et al ,2018).*

The major goal of modern restorative dentistry is preservation of sound tooth structures. However, from biomechanical point of view, the most important priority should be the preservation of residual tooth structures from unfavorable mechanical responses, even if the removal of additional tooth structure is needed. Since the mechanical response of the endodontically treated teeth depends mainly on the amount of remaining structure of the tooth. *(SOARES et al 2018).* It is very important to maintain as much as possible of the remaining tooth tissues.

To explain the reasons / factors contributing to its failure, it is very important to understand the biomechanical behavior of endodontically treated teeth. The decision of restorative technique would depend mainly on remaining tooth structure to assure function and prevent fracture. A reinforcing ferrule design for the restoration is commonly recommended after endodontic treatment to reduce fracture susceptibility using complete crowns that cover all cusps (*Steele, A et al 1999 and Magne P et al, 2014).* Composite resin restorations or ceramic adhesive inlays have been promoted that provide internal teeth reinforcement without occlusal coverage (*Van Dijken et al, 2000 and Hannig et al, 2005).* These strategies do not guarantee a complete restoration of a sound tooth's fracture toughness. In addition, several literature studies have stated that the application of the posts, in addition to the perforation risk during post-space preparation, causes the roots to weaken (*Jindal S et al, 2012 and Ramírez-Sebastià et al, 2014).*

The fracture resistance of the molars treated with endodontic treatment was mainly affected by the number of remaining walls ***(Ziad Salameh et al, 2006)***. Permanent molars were aimed at the present study due to their higher susceptibility for caries and root canal treatment and also to assess the clinical performance of the restorations in stress bearing areas.

In the present study, the thickness of the remaining cavity walls was not less than 2 mm in width and the cavity size buccolingually don't exceed 1/3 to 2/3 of the occlusal table as it was concluded by *Haralur et al,2016* in an invitro study that the endodontically treated teeth with these criteria can have a similar fracture resistance as the non-endodontically treated teeth.

Inclusion and exclusion criteria of the patients are important to decrease the selection bias in any study. In the current study, all patients' age range was between 25-40 years trying to decrease the range to keep it in the middle age range thus excluding the possibility of excessive wear signs. But unfortunately in the current study, choosing one gender over the other was very difficult like what (*Hu and Zhu 2011)* have done in their study when they chose only male participants, and this is considered one of the limitations of the study that might be taken into considerations in the upcoming studies.

In the current study, randomization was dependent on two interrelated aspects, adequate generation of an unpredictable sequence of allocation and hiding of that sequence until the trial occurred. Therefore, the treatment allocation scheme

should be established so that the participants who participated did not realize in advance which treatment the patient would receive. The process is called concealment of allocation *(Moher et al. 2012).* Concealment of allocation was a procedure that prevented any research participant or operator from knowing in advance which treatment would be allocated to the participants. It is crucial that decisions to register participants have been taken in ignorance of the treatment to which they have been allocated, as this information may influence decisions whether or not to register.

The difference between blinding and allocation concealment was that concealment of the allocation was intended to avoid prejudice in the selection process (different subjects were included in the various groups). On the other hand, blinding was intended to avoid bias in performance and commitment (different response to therapy or to calculate the impact of therapy based on the knowledge received from therapy) *(Moher et al. 2012).* In the current study, blinding of the operator was not possible, because main operator was responsible for applying the intervention and control. However, the assessment was done by assessors who were blinded from the followed protocol. In addition, the treatment results were assessed blindly by a statistician.

Multiple isolation was employed to facilitate the application of the matrix system as the presence of the clamp might interfere with matrix ring placement on the same tooth. *(Rocca and Krejci 2007).* Rubber dam was applied during the cavity preparation to decrease as much as possible of the bacterial invasion into the prepared cavity thus, facilitating cleaning and cavity disinfection prior to adhesion procedures, in addition to improving the operator's vision during the whole procedures. Besides protecting the entire oral cavity from any cutting instrument and aspiration of any of the used tools *(Mcm and Wang Y 2016*).

In the present study , the included root canal treated molars were obturated by a non-eugenol based sealer and also temporized by a non-eugenol based provisional restoration to avoid the contamination of the cavity walls with eugenol that might interfere with the polymerization of the adhesive and the resin composite and will reduce the bond strength consequently *(Carvalho et al 2007).* Magnification and accurate rotary instruments give the operator the visual precision and fine planning skills required to preserve healthy tissues and removal of the decay only. Dental magnifying loupes with illumination increased the visual accuracy during the cavity preparation and a more detailed view of healthy and carious structure and also during the restorative procedures as well as during the finishing and polishing *(Eichenberger M, 2018).*

Sectional matrix system was used to restore the proximal contact with the adjacent teeth. The metal bands are pre curved and contoured to restore the normal contact position in posterior teeth which is between the middle and occlusal one thirds. The straight circumferential bands lack the contour and give a straight proximal wall with improper contact position. Resin composites of several consistencies and different application protocols can also affect the tightness of contact point. The use of highly viscous materials appears to be more effective than medium-viscosity materials due to their less polymerization shrinkage while the multi-layer technique showed better contact tightness.

(kampouropolous D et al, 2010). In cases where the adjacent tooth is not in the proper alignment or missed, a saddle precontoured sectional matrix supported by a clip was used (Tor Vm, Russia).

The bonding substrate of the endodontically treated tooth differs than that of the vital tooth. There are structural variations in dentinal collagen: relative to the vital ones, more incomplete bindings can be found in the collagen of non-vital teeth. Dentinal dehydration-induced weakening of the collagen network has also been considered *(Ciucchi B et al 1995 and Pashley DH et al 2002*).The change in the content of tooth moisture due to loss of vitality has a minor effect on Young modulus. This change in the content of water showed no effect on the decrease in compressive and tensile strength *(Huang TJ et al, 1992).* Also, the use of chemical solutions for cleaning the root canal has a negative effect on dentin. Sodium hypochlorite alters the organic substrate of dentin *(Mountouris G et al, 2004)* and shows proteolytic action through organic phase depletion *(Driscoll CO et al, 2002)* leads to a decreased elasticity and flexural strength modulus of dentine *(Grigoratos D et al, 2001).* The mineral content of dentin interacts with chelators such as ethylenediaminetetra-acetic acid (EDTA) and calcium hydroxide, which are widely used for canal irrigation and disinfection. As they primarily deplete calcium by complex formation and also influence non-collagenous proteins: proteoglycans, dentin phosphoproteins and sialoproteins, the outcome is dentin erosion and softening *(Suppa P et al ,2006).*

The adhesion quality between the restoration and the underlying tooth structure, depending solely on the adhesive method, is a very significant factor to consider. Since there is no vital pulp tissues and the dentin quality of the endodontically treated teeth is relatively compromised, a maximum bonding is needed. Total etching technique was the choice as it is the gold standard for adhesion.

Dual cured self-etch adhesive was used in the present study. Due to the increased cavity depth in case of endodontically treated teeth which reaches about 6mm at the base of the pulp chamber, the greater will be the light tip distance. This can decrease the degree of conversion of the adhesive (*Maleknejad F. et al, 2013).* In simplified light cured adhesives with PH < 3, the residual acidic monomers in the underlying oxygen inhibited layer deactivate the initiator component (tertiary amine) inhibiting the polymerization reaction of resin composite resulting in weak polymerization *(Endo T et al, 2007).* In an attempt to circumvent this potential incompatibility and ensure deeper polymerization in the deep parts of the preparations, some simplified light-curing adhesives are currently combined with self-curing activators, typically made up of arylsulfinate salts *(Nunes TG et al,2009)* to develop a new generation of dual-cured self-etch adhesives such as FuturaBond DC used in the present study. The exact composition of each adhesive is a proprietary information.

Active application (rubbing action) of the self-etch adhesive was done for 20 seconds. The penetration of resin monomers found in adhesives can interfere with collagen in the dentin smear *(Takamizawa et al, 2018).* Scanning electron microscope observations of treated dentin surfaces in self-etch mode showed that, compared to those inactively applied, actively applied adhesives would dissolve a certain amount of the smear layer. It can be hypothesised that from functional

monomers in the adhesive, unreacted H+ ions were supplied, resulting in the demineralization process progressing *(Imai A et al ,2017)*. The benefits of active application for optimal dentin bond efficiency and durability with self-etch adhesives have been reported in previous studies (Zhang Y et al, 2013) (Amaral RC et al 2010). It has been proposed that increased dentin bond strength with active application is due to the stirring of adhesive-inducing solvent evaporation, resulting in a higher rate of incorporation of resin monomer within the smear layer. In addition, with active application, the nano layering of calcium-salt derived from hydroxy-appatite and the functional monomer is substantially higher than with inactive application (*Yoshihara K et al, 2011)*. The induction by active application of a chemical reaction among functional monomers and hydroxy-appatite can also decrease acidic monomer levels that would contribute to amine co-initiators and improve the photopolymerization of acidic functional monomer-containing adhesives *(Moszner et al, 2005)*. On the other hand, phosphoric acid pre-etching solubilizes not only the surface debris, but also the dentin substrate subsurface in the etch-and -rinse mode. Fears persist that demineralized dentin will remain at the bottom of the hybrid layer without resin impregnation, which will function in the vicinity of the resin / dentin interface as a weaker area. The risk of biodegradation is increased by this unstable region.

The use of resin composite liners or base material with a low modulus of elasticity as the first increment has become increasingly accepted over the past few years (*Kwon OH et al, 2010)*. Generally positive effects have been reported for the use of flowable composites as stress-breaker intermediate layer. A bulk-fill low viscosity composite was also used below the X-tra fil With its 61 % filler loading (highest among the flowable base bulk-fill composite) in a methacrylate matrix, it's flowable consistency provided more adaptation to the cavity floor and lower modulus of elasticity *(Leprince et al, 2014*). This low elastic modulus was of great benefit as it affected the biomechanical behavior of the restored tooth due to the lower stresses on the root dentin close to the pulp chamber and this consequently increased the fracture resistance *(Periera R et al, 2016).*

Direct composite build ups for endodontically treated teeth without post placement also showed high success rates up to 10 years of observation and that the tooth type and the number of surfaces restored was not an important indicator for the failure rate *(R. J. Wierichs et al, 2018).* On the contrary, this came against other studies that suggested that the use of a fiber post with direct composite build ups showed a higher success rate regarding the marginal discoloration, better marginal integrity and higher restoration integrity *(N. Scotti et al ,2015).* Today, most dentists use light cured direct composite to restore teeth. A restoration is classically placed in increments that are separately healed *(Rees JS et al, 2004)* due to their limited depth of cure. Another reason for using incremental technique is to reduce the polymerization shrinkage even though this theory has also been contradicted *(Bicalho AA et al 2014).* Even with the development of low shrinkage composites, their clinical benefits were not always clear and layering technique was still required *(Schmidt M et al, 2014).*

Nanohybrid resin composite was used as the comparator representing the conventional composite used with incremental technique of application. Nanotechnology aimed to achieve improved fracture resistance, better

compressive and tensile strengths, wear resistance and desired aesthetic performance. Meanwhile the possibility of filling a cavity in bulk has some attractive benefits as this procedure will take less time and less technical errors as voids incorporation and contamination between layers. That demand led the manufacturers to develop bulk-fill resin composite with higher filler loading and more wear resistance with higher depth of cure. As claimed by the manufacturer, it has a depth of cure of 4 mm and filler content 86/70 wt/vol. This filler volume seems to be positively correlated with the material properties as elastic modulus *(Leprince et al ,2014)* strength *(Abouelleil H et al ,2015)* and hardness *(Al Sunbul H et al ,2016)*.

X-tra fil revealed best mechanical properties when compared with most bulk-fill composites *(Czasch P et al,2013 and Goracci C et al,2014)* and indeed due to this high filler loading, the bulk fill composites exhibit less volumetric shrinkage than conventional composites. *(Benetti AR et al, 2015 and Garcia D et al, 2014)* which can provide better marginal integrity.

Caries risk assessment was done prior to the enrollment in this study that allows disease indicators, pathological risk factors and protective factors to be identified and is the keystone of oral health care *(Domejean et al., 2015)*. Among the numerous caries risk assessment approaches mentioned in the last decade are the CAT (Caries-Risk Assessment Tool, of the American Academy of Pediatric Dentistry), the Cariogram and the CAMBRA (Caries Management by Risk Assessment) systems. The Cariogram system was used in the current study for the purpose of caries risk assessment, to assess overall caries risk and to guide the post-operative oral care and preventive measures that will differ from one patient to another (*Zukanovic A ,2013).*

The modified USPHS criteria and the FDI criteria are the most frequently used criteria for assessment of dental restoration. USPHS criteria is a long-standing method for evaluation of dental restorations in clinical trials, Although the USPHS system has worked well for clinical assessment, in short-term clinical assessments, there are some questions about the approach's sensitivity. This scoring system, however, is still being used to compare findings with previous research using the same system in clinical trials (*Bayne et al. 2005 and Celik et al. 2010*). A systematic review was conducted screening studies between 2007 to 2017, to explore criteria used to evaluate dental restorations. Compared with the modified USPHS criteria (30 and 154 published studies, respectively), FDI criteria were found to be little used (*Thomas et al. 2017*). *Follow up period* was selected to be one week (baseline), 3, 6 and 12 months. Baseline assessment should be conducted approximately one week (or no longer than one month) following restoration insertion, and never immediately after placement (*Hickel et al. 2007*). Baseline evaluation after one week provided enough time for relaxation of polymerization shrinkage stresses. Short term follows up period 6 months and 1 year was chosen to evaluate the early clinical success of the X-tra Fil, in particular that no RCT was reported on its success with endodontically treated teeth.

Maintaining strong and leak-proof tooth restoration margins is a key problem for clinically effective and robust resin composite restoration *(Van Merbeek B et al,*

2010. While an important screening is the in vitro testing of restorations, the clear importance of evaluating the clinical efficacy of restorations is not excluded. Lab research demonstrates varying degrees of clinical importance *(Heintze SD, 2013).* The simulation of oral environmental variables, including temperature variations, masticatory forces, pH fluctuations, and others, needs more clinically applicable testing of marginal sealing *(De Munck J et al ,2005).* After data collection and statistical analysis of different outcomes in the present study, it was found that:

Regarding the retention, no statistically substantial differences were found among the two groups at all the follow up periods. This may be attributed to the use of self-etch adhesive with previous dentin etching that led to a more stable adhesive joint between the dentin and the restorative material specially with the active application of the adhesive and being dual cured. Total etching of enamel provided a higher bond strength and more leakage proof margins. This standardized adhesion protocol in both bulk fill and incremental techniques led to a more durable adhesive joint that resulted in a retentive restoration. Also the absence of water in non-vital dentin of ETT can have a positive effect on bond stability as the hydrolysis of the resin and the collagen fibers in the hybrid layer are the main cause of bond degradation *(Frassetto et al ,2016).* This came in accordance with *Lempel et al, 2019* who concluded similar results in their study using the total etch technique (2 steps). Also, the privilege of direct restorations made it unnecessary to remove any cavity undercuts as in cases on indirect restorations. This gave the restoration an additional macro-mechanical mean of retention to the micro-mechanical retention making the restoration more retentive.

While for the results of secondary caries, no statistically substantial differences were found among the two tested materials. After 1 year of study, none of the restorations displayed secondary caries. In particular, this may be due to the short-term observation period because the primary factors that decide if secondary caries can grow or not regardless of the marginal condition if excellent, acceptable or degraded are the patient oral hygiene habits and caries risk *(Jokstad, 2016).* Also, there is a growing agreement now that secondary caries formation could be related to fatigue loading not only by its promoting to gap formation, but also through enhancing further bacterial colonization and demineralization (*Kruzic et al, 2108).*

Regarding the color match, there was a statistically substantial difference in color match in the first 6 months of the study as the bulk fill composite scored a higher percentage of mismatch. This might be explained by the availability of X-tra Base in one universal shade only which made it more difficult to match all the restored teeth is color, while the Grandio was available at different shades making it IS simpler in color matching. Also, the higher translucency of the bulk-fill composite gave it a more grayish color as it was used in a bulk thickness of 4 mm, and also building one complete proximal wall made that mismatch more noticeable. On longer follow up period more discoloration happened for the incremental nano-hybrid group recording a higher mismatch percentage resulting in no significant difference between the 2 groups at 12 months. This came in agreement with *(Colak et al, 2017) and (Yaziki et al, 2017)* who concluded a similar result at 12 and 18 months follow up periods respectively.

While, regarding the results of the marginal adaptation there was no statistically substantial difference among the two groups as most restorations scores 0 and 1 except at 12 months follow up period where the bulk-fill had significantly more score 1 favoring the incremental group. The composition, the filler content of the resin composite and its elastic modulus are known to impact shrinkage and stresses (*Boaro LC et al 2010).* Xtra-fil bulk-fil composite contains mixture of BIS-EMA and aliphatic dimethacrylate all of which are high molecular weight monomers with high viscosity and low polymerization shrinkage. This very slight lack in adaptation (score 1) is considered clinically acceptable and can be considered negligible. This came in accordance with *Benetti et al 2015 and Fronza et al 2015* who found similar marginal integrity between the bulk fill and conventional incremental fill composites. Also, in an invitro study, *Alharbi et al, 2016* evaluated the marginal quality of class II preparations restored with bulk-fill versus incremental technique and they found similar results. However, restorations are subject to temperature changes and, more importantly, masticatory stresses in clinical conditions. A strain accumulation leading to chemical and mechanical degradation is caused by these factors *(Santiago et al 2010).* It may therefore not be precise to compare our results directly with the findings obtained from in vitro studies. On the contrary, this came in disagreement with *(Yaziki et al, 2017)* who found that bulk-fill composites showed better clinical performance than incremental placement, but these results were at follow up periods of 36 months.

For the results of marginal discoloration, there was no statistically substantial difference among the two groups although most of the restorations had a score 1 for both groups at 12 months follow up period. This minor degree of discoloration may be due to the slight lack of adaptation mentioned above. It may be also related to the biodegradation of the adhesive layer with time. This could be proofed by the absence of this discoloration at early observation periods. Dual cure adhesives may fail due to oral environmental changes which couldn't be observed in laboratory studies. These results came in accordance with *(Colak et al, 2017)* who found no significant differences between both bulk and incremental techniques in clinical performance. On the other side, this came in disagreement with *(Yaziki et al, 2017)* who found that most of restorations had a score alpha in the first 18 month of his trial with no marginal discoloration, but they used a different type of adhesive than that in this study.

Regarding the results of anatomic form of the restoration, no statistically substantial difference was found among the two groups as both didn't exhibit any fracture except in one case in the incremental group (score 2). This could be due to that both resin composites used are characterized by having high mechanical properties and high filler loading (75% for Xtra-Base and 87% for Grandio) also the short period of observation (1 year). This came in agreement with (*Moraes et al, 2018).* Fractures of the restorative system are typically a long-term failure due to fatigue while short-term fractures may occur due to improper high impact force (sudden biting on hard objects) or clinical errors such as mistakes in the cavity preparation procedures or presence of voids within the restoration. So, in the present study, thin undermined remaining cavity walls less than 2 mm were excluded as it is more liable to fracture (*Haralur et al,2016*). Also, it could be due

to that in this study patients with bruxism were excluded and this is in accordance with (*Opdam et al 2014)* which reported in their systematic review that bruxism is one of the influencing patient risk factors on survival of posterior restorations causing restoration fracture.

For the surface texture results, there is no statistically significant between the two groups. Few restorations exhibited some slight surface roughness (score 1) in both groups. This may be due to the protocol of finishing and polishing used which warranted long lasting surface finish and polish which is the same protocol in the two groups. Also, the high filler content in the used resin composites gave a higher mechanical and physical properties. In a review of literature comparing reasons for failure of posterior resin composite restorations between 1995–2005 and 2006–2016 periods, It was found that there is a decline in finding wear as a cause for failure in the last decade due to the great advance made in resin composite technology *(Alvanforoush et al ,2017).* This came in accordance with *(Colak et al, 2017)* who performed a similar study but on vital teeth and found no clinical differences regarding the surface texture between bulk-fill and micro-hybrid conventional composite in class II cavities at 12 months follow up.

Based upon the previous findings, we can find a very little or negligible differences in the clinical performance of Bulk-fill and conventional nano-hybrid resin composite after 1-year follow up period. Thus, the hypothesis is accepted. Both techniques offer clinically acceptable functioning restorations taking in consideration that bulk fill technique is more time saving, easier and less technique sensitive. So, in order to choose one of them, it depends on the patient and dentist decision.

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