AJDS LAZHAR Al-Azhar Journal of Dental Science
Vol. 27- No. 4- 467:477- October 2024
Print ISSN 1110-6751 | online ISSN 2682 - 3314
https://ajdsm.journals.ekb.eg
Restorative Dentistry Issue (Dental Biomaterials, Operative Dentistry, Endodontics, Removable & Fixed Prosthodontics)

EVALUATION OF THE EFFECT OF OCCLUSO-GINGIVAL DISTANCE AND DIFFERENT SHAPES OF NON-CARIOUS CERVICAL LESIONS ON THE CLINICAL PERFORMANCE OF RECENT TYPES OF RESTORATIVE MATERIALS. *(AN IN VIVO STUDY)*

Nasser Shehab[1], Kalid Noaman[2], Abdallah Abdelhady[3]

ABSTRACT

Objective: This trial was done for evaluation of the evaluate the effect of occluso-gingival distance and different shapes of non-carious cervical lesions on the clinical performance of recent types of restorative materials**. Subjects and Methods:** Eighty-seven participants with 126 non-carious cervical lesions (NCCLs) in first maxillary premolar were divided into two main groups according to Occluso-gingival distance (OGD), each main group was equally subdivided into three subgroups according to the shape of NCCLs, after that, each subgroup was further subdivided into three subgroups according to restorative materials, Filtek Z350 XT, Filtek Bulk Fill Posterior and ketac nano 100. Two calibrated examiners conducted clinical evaluations using the modified US Public Health Service (USPHS) criteria to assess retention, marginal staining, marginal adaptation, recurrence of caries, and postoperative sensitivity at 7 days, 6 months, and 1 year. **Results:** clinical evaluation of restored NCCLs after all follow-up periods at OGD of 1.5-mm and 3-mm showed a non-statistically significant difference. Where ketac nano 100 showed best retention rate followed by Filtek Bulk Fill Posterior and Filtek Z350 XT. While the results showed a statistically significant difference at 6-months, and 1-year follow-up periods respectively for marginal staining with best rate recorded for Filtek Bulk Fill Posterior and Filtek Z350 XT and the lowest rate was recorded for ketac nano 100. However, no statistically significant difference at baseline. **Conclusions:** All tested materials used in this clinical study presented an acceptable result at the 12 months evaluation.

KEYWORDS: Filtek Z350 XT, Filtek Bulk fill posterior, Ketac nano100, non-carious cervical lesions, Restorative materials.

INTRODUCTION

Due to their histological and structural characteristics, non-carious cervical lesions (NCCLs) constitute a unique challenge for restorative management. The main etiological reasons for these lesions include erosion, abrasion, and abfraction, despite of the complexity of their development. Erosion is the term used to describe the loss of hard dental tissue brought on by chemical acids (such as those found in vinegar drinks) and mechanical causes (such as brushing of the teeth)[(1)]. The breakdown of the hard cervical dental tissue brought on by a concentration of tensile forces during significant non-axial occlusal loading is explained by the abfraction concept. The edges of NCCLs frequently occur in an aqueous environment in a subgingival position and may be in enamel, cementum,

1. Assistant literature, Operative Dentistry, Faculty of Dental Medicine, Al Azhar University, Cairo.
2. Professor of Operative Dentistry, Faculty of Dental Medicine, Al Azhar University, Cairo.
3. Assistant Professor Operative Dentistry, Faculty of Dental Medicine, Al Azhar University, Cairo.

• ***Corresponding author*:** nassershehab.209@azhar.edu.eg

DOI: *10.21608/ajdsm.2022.164376.1371*

or dentin. Some cavities are difficult to access or cannot be effectively isolated [2].

In addition to negatively affecting structural integrity, dental plaque retention, sensitivity of teeth, vitality of the pulp, and aesthetics appearance, NCCLs are rather prevalent clinical disorders. Cervical lesions can have a variety of clinical appearances depending on the nature and intensity of the underlying etiological causes. Currently, it is incorrect to attribute NCCLs to a single factor. However, the most current data points to a multifactorial nature of NCCLs that is dependent on patient circumstances to varying degrees of the losing hard dental tissue[3].

NCCLs can affect just the tooth's crown (enamel and/or coronal dentin), just the surface of the root (cementum and/or root dentin), or affect both, the crown and exposed root. The gingival recession is frequently linked to root-related NCCLs [4]. The type and intensity of the contributing etiological factors can have an impact on the clinical presentation of NCCLs[5].

The longevity outcomes from restorative or alternative interventions and minimizing subsequent hard dental tissue loss is largely depending on dentists' ideas[6].

The size of the lesion, rate of sensitivity, and required aesthetics all directly influence the necessity for restorative treatment. Restoration treatments can be difficult because most cavity designs don't allow for self-retention, and due to the cervical margin's subgingival location, it is more difficult to prevent crevicular fluid, blood, and saliva from contaminating the operating field [7].

In the case of uncontrolled plaque retention, improper cosmetic appearance, unmanaged hypersensitivity, evident progression of the lesion, and elevated the risk of cervical caries, the restoration of NCCLs is a frequently recommended therapeutic option. However, due to the existence of sclerotic structure, absence of a retention area, and the cervical region subject to concentrations of forces, the clinical success with restorative treatment is challenging [8].

For restoring NCCLs, resin-modified glass ionomer cements get the best chances of success. Moreover, for restoring NCCLs conventional composites used with two-step etch-and-rinse adhesives also produce positive results. However, the resin composites adhesion is a complicated process that depends on the setting reaction, dental substrate type and quality, adhesive system type, the application procedures, management the moisture contamination, and the material's inherent adhesive properties[9].

MATERIALS AND METHODS

The materials used in this study were as follows:

A. Restorative materials

1. Nano-hybrid resin composite (Filtek Z350 XT).
2. Bulk fill resin composite (One Bulk Fill restorative).
3. Nano-filled resin modified glass ionomer cement (Ketac Nano100 light-curing glass ionomer restorative) 3M ESPI.

B. Adhesive material

1. Two-step self-etch adhesive (Clearfil Liner Bond F).

Ethical approval and consent form:

The institutional Ethics Committee approval reference No. (479/1123) at the Faculty of Dental Medicine, Al-Azhar University Ethics Committee, gave their approval to this trial. Each patient received information about the study's purpose, provided the consent to participate, and signed a consent form (in regional language) before the start of the study.

Eligibility criteria:

Following were the inclusion criteria: Healthy patients with good oral hygiene, with an age range between 30-and 60 years and at least one maxillary first premolar with NCCL indicated for restoration,

with no clinical evidence of periodontal disease and appropriate field isolation after cavity preparation. While the **Exclusion criteria were:** Badly broken maxillary first premolar tooth, previously restored tooth, and Unhealthy patients and/or patients with bad oral hygiene. **Criteria for discontinuation:** Mortality or acquiring a severe debilitating disease.

Sample calculation and Grouping:

Based on previous work [10]sample size of 63 in each main group has a 80% power to detect an increase in survival proportion of 0.495 with a significance level (alpha) of 0.05 (two-tailed). The results will be regarded as "statistically significant" if the P value is less than 0.05 (two-tailed) in 80% (the power) of those experiments. The increase in survival rate in the remaining 20% of the experiments will be labelled as "not statistically significant." Report created by Graph Pad Stat Mate 2.00.

Subject grouping:

A total number of 126 NCCLs were divided into two main groups (n=63) according to OGD as follows:

Group A1: NCCLs with OGD 1.5-mm±10% (n=63), and Group A2: NCCLs with 3-mm±10% (n=63). Then each main group was equally subdivided into three subgroups (n=21) according to the shape of NCCLs (notch, saucer, or mixed) as follows: Subgroup B1: Notch-shape NCCLs (n=21), Subgroup B2: Saucer-shape NCCLs (n=21), Subgroup B3: Mixed- shape NCCLs (n=21). After that, each subgroup was further subdivided into three divisions (n=7) according to restorative materials as follow; Nano-hybrid Filtek Z350 XT (C1), Filtek Bulk Fill Posterior (C2), and Ketac Nano 100 (C3) at different interval times

- ***Randomization and allocation***

Randomization of the restoration used in the present study was done by the envelope draw method for all the selected NCCLs in the same patient. For each patient, at least a single maxillary first premolar tooth was included in the study. If a patient needed treatment for more than one tooth, each tooth was chosen for the study at random by computer program.

Restorative treatment: For the NCCLs of the maxillary first premolar, the restorative treatment for rehabilitation of aesthetics and health due to loss of hard dental tissue was indicated.

For all NCCLs that were restored by Filtek Z350 XT and Filtek Bulk Fill composites the following procedures were carried out:

In the beginning, dental prophylaxis was performed using a polishing paste (Detartrine, Septodent) to remove the biofilm. After that, little increments of composite resin were applied to the tooth's surface around the area that would be restored, and light cured to determine the shade of composite resin. Then the operative field was relative isolated. To reveal the lesion's margin and stop the flow of crevicular fluid, a retracting cord was placed into the gingival sulcus. A front lip retractor, cotton rollers, and high-power suction were also used to surrounding field isolation.

A self-etching adhesive system (Clearfil Liner Bond F, Kuraray, Tokyo, Japan) was applied in accordance with the manufacturer's recommendations. The adhesive system's primer was vigorously applied for 20 seconds, then two bond layers were placed after a gentle air drying. The photopolymerization of the adhesive system was carried out in accordance with the manufacturer's guidelines using a LED light device (LED.F, woodpecker, Guilin, Guangxi, china). Small increments of composite resin were used in the layering procedure to decrease the tension brought on by the polymerization, first the cavity cervical margin and then the occlusal margin using a brush to remove any excess material and to create a homogeneous and smooth surface. The manufacturer recommended light curing each increment of composite resin for 20 seconds. The retraction cord was cut after the last light curing, and finishing procedures began.

Using flexible discs with decreasing granulation (TOR VM, Moscow, Russia), the finishing and polishing processes were carried out following the manufacturer instructions by using the blue disk followed by the green one for finishing then using the yellow disk for smoothing the surface and finally the white disk for extra smoothing until obtaining a highly smooth surface. The result of finishing and polishing procedures showed polished surface, shining, and restored that resembles the natural, and a properly adapted surface.

For all NCCLs that were restored by Ketac Nano (RMGIC) the following procedures were carried out:

In the beginning, before starting the restoration procedures; the appropriate shade was selected using a shade guide. Then, Ketac primer was then applied for 15 seconds and then air-dried for additional 10 seconds and finally light-cured with an LED light-curing unit for 10 seconds. Afterthought the Ketac Nano capsule was flipped open to 180 degrees, so the tip is completely in line with the capsule body and finally, the restorative material was delivered slowly. Thereafter the applicator instrument was wetted with primer before material adaptation to increase the adaptation of the Ketac Nano restorative material to the cavity outline without sticking. After material application and adaptation, it was light-cured with an LED light-curing unit for 20-second. After curing, if an additional application was required, the additional layer application was performed within 1 minute ±30 seconds of the previous placement from the same capsule. The finish and polish of the restoration were performed using the same manner as the resin composite groups.

Observation and clinical evaluation

Two calibrated examiners conducted clinical evaluations using the modified US Public Health Service (USPHS) criteria to assess fractures/ retention, marginal staining, marginal adaptation, recurrence of caries, and postoperative sensitivity at baseline (7 days), 6 months, and 1 year. The results of each observation were listed in (**Table 1**) as follows:

TABLE (1) The criteria for clinically evaluating restorations are described as follows:

Criteria	Score	Description of the criteria
Marginal adaptation	Alfa (A)	There is no visual evidence of marginal fracture in the interface tooth/restoration.
	Bravo (B)	There are visible and tactile evidence of the presence of cleft, but the dentin is not exposed.
	Charlie (C)	The explorer penetrates the tooth/restoration interface with exposed dentin.
Marginal staining	Alfa (A)	There is no visual evidence of marginal discoloration on the tooth/restoration interface.
	Bravo (B)	There is visual evidence of marginal discoloration,
	Charlie (C)	Extent of discoloration deep to the pulp.
Retention	Alfa (A)	Presence of restoration.
	Charlie (C)	Partial or total absence of restoration.
Recurrent caries	Alfa (A)	There is no visual evidence of decay in the tooth/restoration interface.
	Charlie (C)	There is visual evidence of decay in the tooth/restoration interface.
Post-operative Sensitivity	Alfa (A)	Absence of painful symptoms to thermal stimuli and / or percussion.
	Charlie (C)	Presence of painful or spontaneous symptoms reported by the patient.

Statistical analysis

SPSS statistical version 21 was used for the statistical analysis (Statistics Statistical Procedures Companion, Chicago, IL, USA). The Kolmogorov-Smirnov test was used to verify the normality of distribution. The Chi-square test was used for the comparison of all binary outcome data at different times points The Significance level was set at $P<0.05$.

RESULTS

1. Retention:

The **chi-square (X^2)** statistical test results of the clinical evaluation of retention of different restorative materials after all follow-up periods at OGD of 1.5-mm showed a non-statistically significant difference. While at OGD of 3-mm the results showed a statistically significant difference at 6-months, and 1-year follow-up periods (P=0.047, and 0.032) respectively, however, no statistically significant difference at baseline. Data are summarized in **(Table 2).**

TABLE (2) Retention of restorative material of NCCLs:

OGD	Restorative material	Score	Baseline (7 days)	6-Months	1-Year	(χ^2)	P-value
1.5 mm	Filtek Z350 XT	Alfa (A)	21 (100%)	19 (90.5%)	17 (81%)	12.73	0.001*
		Charlie (C)	0 (0%)	2 (9.5%)	2 (9.5%)		
	One Bulk Fill	Alfa (A)	21 (100%)	19 (90.5%)	18 (85.7%)	8.02	0.018*
		Charlie (C)	0 (0%)	2 (9.5%)	3 (14.3%)		
	ketac Nano	Alfa (A)	21 (100%)	18 (85.7%)	18 (85.7%)	4.17	0.123 NS
		Charlie (C)	0 (0%)	3 (14.3%)	3 (14.3%)		
	P-value		NAN	0.525 NS	0.145 NS		
	χ^2		0	1.28	3.85		
3 mm	Filtek Z350 XT	Alfa (A)	21 (100%)	19 (90.5%)	17 (81%)	11.2	0.003*
		Charlie (C)	0 (0%)	2 (9.5%)	3 (14.3%)		
	One Bulk Fill	Alfa (A)	21 (100%)	19 (90.5%)	18 (85.7%)	6.3	0.109 NS
		Charlie (C)	0 (0%)	2 (9.5%)	2 (9.5%)		
	ketac Nano	Alfa (A)	21 (100%)	21 (100%)	19 (90.5%)	4.13	0.126 NS
		Charlie (C)	0 (0%)	0 (0%)	1 (4.54%)		
	P-value		NAN	0.047*	0.032*		
	χ^2		0	6.10	6.82		

**; significant at p < 0.05. ; non-significant at p >0.05. ns= non-significant.*

2. Marginal staining:

The **chi-square (X^2)** statistical test results of the clinical evaluation of marginal staining of different restorative materials regardless of the shape of NCCLs after all follow-up periods at OGD of 1.5-mm showed a non-statistically significant difference (P= NAN) at baseline, while there was a statistically significant difference at 6-months, and 1-year follow-up periods (P=0.00001). While at OGD of 3-mm the results showed a statistically significant difference at 6-months, and 1-year follow-up periods (P<0.0000), however, no statistically significant difference at baseline (P= NAN). Data are summarized in (Table 3).

TABLE (3) Marginal staining of restorative material regardless of the shape of NCCLs.

OGD	Restorative material	Score	Baseline (7 days)	6-Months	1-Year	(χ^2)	P-value
1.5 mm	Filtek Z350 XT	Alfa (A)	21 (100%)	15 (71.4%)	14 (66.7%)	0	NAN
		Bravo (B)	0 (0%)	4 (19.2%)	3 (14.3%)		
		Charlie (C)	0 (0%)	0 (0%)	0 (0%)		
	One Bulk Fill	Alfa (A)	21 (100%)	16 (76.2%)	15 (71.4%)	0	NAN
		Bravo (B)	0 (0%)	3 (14.3%)	3 (14.3%)		
		Charlie (C)	0 (0%)	0 (0%)	0 (0%)		
	ketac Nano	Alfa (A)	21 (100%)	6 (28.6%)	2 (9.5%)	25.08	0.00004*
		Bravo (B)	0 (0%)	3 (14.4%)	6 (28.6%)		
		Charlie (C)	0 (0%)	9 (43%)	9 (43%)		
	P-value		NAN	0.00001*	0.00011*		
	χ^2		0	27.3	23.1		
3 mm	Filtek Z350 XT	Alfa (A)	21 (100%)	15 (71.4%)	15 (71.4%)	0	NAN
		Bravo (B)	0 (0%)	4 (19.2%)	3 (14.4%)		
		Charlie (C)	0 (0%)	0 (0%)	0 (0%)		
	One Bulk Fill	Alfa (A)	21 (100%)	19 (90.5%)	18(85.7%)	0	NAN
		Bravo (B)	0 (0%)	2 (9.5%)	2 (9.5%)		
		Charlie (C)	0 (0%)	0 (0%)	0 (0%)		
	ketac Nano	Alfa (A)	21 (100%)	6 (28.6%)	0 (0%)	27.6	0.00001*
		Bravo (B)	0 (0%)	6 (28.6%)	7 (33.3%)		
		Charlie (C)	0 (0%)	9 (42.9%)	12 (57.1%)		
	P-value		NAN	<0.0000*	<0.0000*		
	χ^2		0	34.1	37.4		

3. Marginal adaptation:

The **chi-square (X^2)** statistical test results of the clinical evaluation of marginal adaptation of different restorative materials regardless of the shape of NCCLs after all follow-up periods at OGD of 1.5-mm showed a non-statistically significant difference (P= NAN and 0.163) at baseline and 1-year follow-up periods respectively, while there was a statistically significant difference at 6-months (P=0.019). While at OGD of 3-mm the results showed a statistically significant difference at 6-months (P= 0.0013), however, no statistically significant difference (P= NAN and 0.056) at baseline, and 1-year follow-up periods. Data are summarized in (Table 4).

TABLE (4) Marginal adaptation of restorative material regardless of the shape of NCCLs

OGD	Restorative material	Score	Baseline (7 days)	6-Months	1-Year	(χ^2)	P-value
1.5 mm	Filtek Z350 XT	Alfa (A)	21 (100%)	15 (71.4%)	9 (43%)	0	NAN
		Bravo (B)	0 (0%)	0 (0%)	2 (9.5%)		
		Charlie (C)	0 (0%)	0 (0%)	0 (0%)		
	One Bulk Fill	Alfa (A)	21 (100%)	16 (76.2%)	11 (52.4%)	0	NAN
		Bravo (B)	0 (0%)	0 (0%)	3 (14.3%)		
		Charlie (C)	0 (0%)	0 (0%)	0 (0%)		
	ketac Nano	Alfa (A)	21 (100%)	12 (57.1%)	8 (30.1%)	13.1	0.010*
		Bravo (B)	0 (0%)	3 (14.4%)	5 (23.8%)		
		Charlie (C)	0 (0%)	3 (14.4%)	3 (14.4%)		
	P-value		NAN	0.019*	0.163 NS		
	χ^2		0	11.7	6.5		
3 mm	Filtek Z350 XT	Alfa (A)	21 (100%)	16 (76.2%)	10 (47.6%)	0	NAN
		Bravo (B)	0 (0%)	0 (0%)	2 (9.5%)		
		Charlie (C)	0 (0%)	0 (0%)	0 (0%)		
	One Bulk Fill	Alfa (A)	21 (100%)	19 (90.5%)	14 (66.7%)	0	NAN
		Bravo (B)	0 (0%)	0 (0%)	3 (14.4%)		
		Charlie (C)	0 (0%)	0 (0%)	0 (0%)		
	ketac Nano	Alfa (A)	21 (100%)	12 (57.1%)	9 (43%)	15.9	0.0030*
		Bravo (B)	0 (0%)	6 (28.6%)	8 (30.1%)		
		Charlie (C)	0 (0%)	3 (14.4%)	3 (14.4%)		
	P-value		NAN	0.0013*	0.056 NS		
	χ^2		0	17.8	9.2		

4. Recurrent caries:

The chi-square (X2) statistical test results of the clinical evaluation of recurrent caries of different restorative materials regardless of the shape of NCCLs after all follow-up periods at OGD of 1.5-mm and 3-mm showed non-statistically significant differences at all follow-up periods. Data are summarized in (Table 5).

TABLE (5) Recurrent caries of restorative material regardless of the shape of NCCLs

OGD	Restorative material	Score	Baseline (7 days)	6-Months	1-Year	(χ^2)	P-value
1.5 mm	Filtek Z350 XT	Alfa (A)	21 (100%)	13 (61.9%)	9 (42.9%)	6.4	0.04*
		Charlie (C)	0 (0%)	2 (9.5%)	2 (9.5%)		
	One Bulk Fill	Alfa (A)	21 (100%)	14 (66.7%)	11 (52.4%)	4.5	0.102 NS
		Charlie (C)	0 (0%)	2 (9.5%)	3 (14.3%)		
	ketac Nano	Alfa (A)	21 (100%)	15 (71.4%)	12 (57.1%)	4.3	0.111 NS
		Charlie (C)	0 (0%)	3 (14.3%)	3 (14.3%)		
	P-value		NAN	0.934 NS	0.979 NS		
	χ^2		0	0.13	0.04		
3 mm	Filtek Z350 XT	Alfa (A)	21 (100%)	16 (76.2%)	9 (42.9%)	9.8	0.007*
		Charlie (C)	0 (0%)	0 (0%)	3 (14.3%)		
	One Bulk Fill	Alfa (A)	21 (100%)	16 (76.2%)	13 (61.9%)	4.11	0.128 NS
		Charlie (C)	0 (0%)	3 (14.3%)	3 (14.3%)		
	ketac Nano	Alfa (A)	21 (100%)	18 (85.7%)	13 (61.9%)	6.49	0.03*
		Charlie (C)	0 (0%)	3 (14.3%)	5 (23.8%)		
	P-value		NAN	0.257 NS	0.822 NS		
	χ^2		0	2.7	0.38		

5. Postoperative sensitivity:

The chi-square (X2) statistical test results of the clinical evaluation of postoperative sensitivity of different restorative materials regardless of the shape of NCCLs after all follow-up periods at OGD of 1.5-mm and 3-mm showed non-statistically significant differences at all follow-up periods. Data are summarized in (table 6).

TABLE (6) Postoperative sensitivity of restorative material regardless of the shape of NCCLs

OGD	Restorative material	Score	Baseline (7 days)	6-Months	1-Year	(χ^2)	P-value
1.5 mm	Filtek Z350 XT	Alfa (A)	17 (81%)	13 (61.9%)	9 (42.9%)	0.21	0.897 NS
		Charlie (C)	4 (19%)	2 (9.5%)	2 (9.5%)		
	One Bulk Fill	Alfa (A)	17 (81%)	14 (66.7%)	11 (52.4%)	0.29	0.863 NS
		Charlie (C)	4 (19%)	2 (9.5%)	3 (14.3%)		
	ketac Nano	Alfa (A)	20 (95%)	15 (71.4%)	12 (57.1%)	2.1	0.344 NS
		Charlie (C)	1 (5%)	3 (14.3%)	3 (14.3%)		
	P-value		0.311 NS	0.934 NS	0.979 NS		
	χ^2		2.3	0.13	0.04		
3 mm	Filtek Z350 XT	Alfa (A)	18 (85.7%)	16 (76.2%)	9 (42.9%)	4.1	0.126 NS
		Charlie (C)	3 (14.3%)	0 (0%)	3 (14.3%)		
	One Bulk Fill	Alfa (A)	20 (95%)	16 (76.2%)	13 (61.9%)	1.9	0.384 NS
		Charlie (C)	1 (5%)	3 (14.3%)	3 (14.3%)		
	ketac Nano	Alfa (A)	20 (95%)	18 (85.7%)	13 (61.9%)	4.0	0.132 NS
		Charlie (C)	1 (5%)	3 (14.3%)	5 (23.8%)		
	P-value		0.419 NS	0.257 NS	0.822 NS		
	χ^2		1.7	2.7	0.38		

DISCUSSION

The present study's findings shown that, regardless of the OGD, the resin-based restorations (Nano-hybrid resin composite, Bulk fill resin composite, and Nano-filled RMGIC) displayed acceptable clinical performances without a significant difference in any clinical parameters after 12 months. Our findings are consistent with other research that looked at how well-performing RMGIC and resin-based composites performed in terms of marginal discoloration, recurrent caries, postoperative sensitivity, and tooth vitality[11].

The "two-step self-etch adhesive" that was used to bond chemically with the tooth's hydroxyapatite through its phosphate groups and even without increased mechanical retention, compared to other monomers, it has a stronger bond and is more stable in water, may be responsible for the tested restorative materials' good clinical performance at 12 months[12].

According to the findings of this study, the three restorations that were put to the test were retained regardless of how the NCCLs were shaped on the buccal surface of the maxillary premolar. These results follow Soares et al in 2015,[12] who reported that the morphology of NCCLs has a minimum effect on the pattern of stress distributions. This may be explained by the findings of earlier research, which indicate that the use of an adhesive "bonding agent" could result in a successful bonding between the restoration and tooth structure because of its elasticity, which is comparable to that of dentine and is thought to be sufficient to counteract the stress created by occlusal forces[13].

The current study's findings also demonstrated that there were no significant differences in retention rates among any of the restorations placed in lesions with 1.5 mm OGD during various follow-up intervals. Similar results were found in other clinical studies, where the authors hypothesized

that certain traits, such as obtusely angled lesions in posterior immobile teeth with group function, predispose restorations to retentive failures[10].

After 6 and 12 months of follow-up, however, restorations inserted into lesions with 3 mm OGD revealed considerable variations in retention rates. The direction of the enamel prisms and dentinal tubules in this area, which is in a transverse direction to the long axis of the tooth, may be responsible for the concentration of stresses and subsequent failure in the cervical sections of enamel and dentine[14].

The results showed that after 6 and 12 months of follow-up periods, the best retention was recorded with the Nano-filled RMGIC, followed by Bulk fill resin composite, and the lower retention rates were recorded with Nano-hybrid resin composite. The chemical attachment capacity of the Nano-filled RMGIC to calcified tooth tissues and their dentin-like flexibility were linked to these clinical findings[15]. The Nano-hybrid and Bulk Fill resin Composites, on the other hand, bind to the tooth tissues through mechanical interlocking in enamel and hybridization through adhesive systems in dentin[16]. Conventional micro-hybrid RBCs were also said to fail more frequently than RMGIC because they could not be able to handle the tension that happens at the adhesive contact when the tooth neck stretches during occlusal loading[17].

However, evaluated materials showed a moderate decline from baseline to the completion of the year regarding the marginal adaption and marginal staining, still falling within a range that is clinically acceptable. The Nano RMGIC, however, experienced a considerable drop in marginal adaption over time. The marginal chippings on the Nano RMGIC restorations may be to blame for this clinical outcome. [11] Additionally, it was noted in clinical trials that the marginal staining had been connected to the existence of a marginal defect[12].

Additionally, the limited demineralization, depth, and extent of moderate self-etch adhesives could be responsible for the slight deterioration at the enamel side in the current investigation [18] In fact, according to some authors, the self-etch method is more likely to result in surface discolouration[19]. Marginal staining can also be related to patients' eating patterns and mouth microflora [20]. Despite a rather quick onset (after 6 months for resin composites and 3 months for RMGIC), the staining in the current investigation met the new USPHS criteria and was considered clinically acceptable (Bravo). In these cases, the restoration margins can be repaired without being damaged to improve aesthetics[12]. It is important to note that the discolorations were minor and just surface-level, and they did not require correction. In the current study, regarding caries recurrence and postoperative hypersensitivity, the tested restorations did not significantly differ from one another at all different NCCLs shapes and dimensions. This may be related to the properties of the "two-step self-etch adhesive" that is being used. These adhesive forms a chemical bond with the tooth's hydroxyapatite through its phosphate groups, offering a stronger bond and greater stability in water than other monomers, even in the absence of additional mechanical retention. [11] However, the considerable reduction in caries recurrence over time in Nano-RMGIC may be related to the marginal integrity of these restorations deteriorating with time because of little chippings on the restoration margins [13].

CONCLUSIONS

a. All tested materials used in this clinical study presented an acceptable result at the 12 months evaluation.

b. The OGD and shape of NCCLs did not affect the clinical performance of restorative materials used.

c. Regardless The OGD and shape of NCCLs, retention rate of restoration depends on the mechanical properties of restorative materials and adhesive system used.

REFERENCES

1. Kampanas N-S, Antoniadou MJJofb. Glass ionomer cements for the restoration of non-carious cervical lesions in the geriatric patient. Journal of functional biomaterials. 2018;9(3):42.
2. Sharafeddin F, Feizi N. Evaluation of the effect of adding micro-hydroxyapatite and nano-hydroxyapatite on the microleakage of conventional and resin-modified Glass-ionomer Cl V restorations. Journal of clinical and experimental dentistry. 2017;9(2): 242.
3. El-Marakby A, Al-Sabri F, Alharbi S, Halawani S, Yousef M. Noncarious cervical lesions as abfraction: etiology, diagnosis, and treatment modalities of lesions: a review article. Dentistry. 2017;7(438):1-6.
4. Dursun E, Güncü GN, Dursun CK, Kiremitçi A, Karabulut E, Akalın FA. Nanofilled and conventional resin-modified glass ionomer fillings combined with connective tissue grafts for treatment of gingival recessions with non-carious cervical lesions. Journal of oral science. 2018;60(3):344-51.
5. Nascimento MM, Dilbone DA, Pereira PN, Duarte WR, Geraldeli S, Delgado AJ. Abfraction lesions: etiology, diagnosis, and treatment options. Clinical, cosmetic and investigational dentistry. 2016;8:79.
6. Vatu M, Vintilă D, Popa DL, Mercuţ R, Popescu SM, Vintila G, editors. Determining Mechanical Causes that Produce Dental Wear Using Finite Element Method. Applied Mechanics and Materials; 2020: Trans Tech Publ.
7. Canali GD, Ignácio SA, Rached RN, Souza EM. One-year clinical evaluation of bulk-fill flowable vs. regular nanofilled composite in non-carious cervical lesions. Clinical oral investigations. 2019;23(2):889-97.
8. Celik EU, Tunac AT, Yilmaz F. Three-year clinical evaluation of high-viscosity glass ionomer restorations in non-carious cervical lesions: a randomised controlled split-mouth clinical trial. Clinical oral investigations. 2019;23(3):1473-80.
9. Roman A, Stratul SI, Rusu D, Boariu M, Soanca A, Balazsi R, et al. Investigations on the adhesion of new composites for restoring cervical lesions using energy dispersive X-ray analysis and scanning electron microscopy. Scientific reports. 2019;9(1):1-10.
10. Correia A, Jurema A, Andrade M, Borges A, Bresciani E, Caneppele T. Clinical Evaluation of Noncarious Cervical Lesions of Different Extensions Restored With Bulk-fill or Conventional Resin Composite: Preliminary Results of a Randomized Clinical Trial. Operative Dentistry. 2020;45(1): 11-20.
11. Koc Vural U, Meral E, Ergin E, Gürgan SJCOI. Twenty-four-month clinical performance of a glass hybrid restorative in non-carious cervical lesions of patients with bruxism: a split-mouth, randomized clinical trial. Clinical oral investigations.2020;24(3):1229-38.
12. Andreaus U, Colloca M, Iacoviello DJCm, biomedicine pi. Coupling image processing and stress analysis for damage identification in a human premolar tooth.computer methods and programs in biomedicine. 2011;103(2):61-73.
13. Fron H, Vergnes J-N, Moussally C, Cazier S, Simon A-L, Chieze J-B, et al. Effectiveness of a new one-step self-etch adhesive in the restoration of non-carious cervical lesions: 2-year results of a randomized controlled practice-based study. dental materials. 2011;27(3):304-12.
14. Miura J, Maeda Y, Nakai H, Zako MJDm. Multiscale analysis of stress distribution in teeth under applied forces. dental materials.2009;25(1):67-73.
15. Vaid DS, Shah NC, Bilgi PSJJocdJ. One year comparative clinical evaluation of EQUIA with resin-modified glass ionomer and a nanohybrid composite in noncarious cervical lesions. Journal of conservative dentistry: 2015;18(6):449.
16. Carvalho RM, Manso AP, Geraldeli S, Tay FR, Pashley DHJDm. Durability of bonds and clinical success of adhesive restorations. dental materials.2012;28(1):72-86.
17. Özgünaltay G, Önen AJJoOR. Three-year clinical evaluation of a resin modified glass–ionomer cement and a composite resin in non-carious class V lesions. Journal of Oral Rehabilitation2002;29(11):1037-41.
18. Peumans M, De Munck J, Van Landuyt K, Van Meerbeek BJDM. Thirteen-year randomized controlled clinical trial of a two-step self-etch adhesive in non-carious cervical lesions. dental materials.2015;31(3):308-14.
19. Burrow M, Tyas MJADJ. Clinical investigation of G-Bond resin-based adhesive to non-carious cervical lesions over five years. Australian Dental Journal 2012;57(4):458-63.
20. Rizzante FAP, Duque JA, Duarte MAH, Mondelli RFL, Mendonca G, Ishikiriama SKJDmj. Polymerization shrinkage, microhardness and depth of cure of bulk fill resin composites. dental materials. 2019;38(3):403-10.