

An Assessment on the Clinical Performance of Non-carious Cervical Restorations

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ABSTRACT

Introduction: Cervical restorations were known as the least durable type of restoration. Therefore, it is important for clinician to identify the contributing factors that may lead to failure of the restorations. **Objective:** The purpose of this study was to compare the clinical performance in terms of type of restorative materials and the influence of clinical handling technique of non-carious cervical restorations. **Materials and Methods:** This cross-sectional study was carried out to patients with restorations on non-carious cervical lesions (NCCLs) at Universiti Sains Islam Malaysia dental clinic. The clinical performance of the restorations was evaluated using the ratings of the United States Public Health Service criteria and analyzed using the Pearson Chi-square. **Results:** A total of 121 restorations from 34 patients were evaluated by one investigator. Between three restorative materials used which are glass ionomer cements (GIC), RC, and resin-modified GIC (RMGIC), criteria of marginal integrity, marginal discoloration, and anatomic form were not significantly different ($P = 0.179$, $P = 0.134$, and $P = 0.235$, respectively; $P < 0.05$). In terms of retention and secondary caries, GIC showed statistically significant difference ($P = 0.021$). The restorations that were evaluated as clinically acceptable showed no significant difference between restorations with and without cavity preparation. **Conclusion:** Different restorative materials used will affect the longevity of the restorations, but different clinical handling technique does not affect the clinical performances of NCCLs restorations. In this study, the clinical performance of GIC was superior to RC and RMGIC in terms of retention and occurrence of secondary caries but similar in marginal integrity, marginal discoloration, and anatomic form.

Key words: Composites, glass ionomer cements, non-carious cervical lesions, resin-modified glass ionomer cements

INTRODUCTION

A non-carious cervical lesion (NCCL) is a dental hard tissue defect of unknown origin that has two very distinct variations, a wedge-shaped and a saucer-shaped lesion.^[1] The lesion is characterized by the loss of structure in the coronal part of the tooth, known as the cementum-enamel junction (CEJ), placing it at the union between the enamel of the crown and the root of the tooth.^[2] The layer of enamel in this area is thinner, less hard and the direction of the prisms is straight and vertical on the surface of CEJ.^[3,4] The bond between the enamel and dentine is weaker

because the junction is smooth without ridges.^[5] The enamel is irregularly structured, i.e., it is an area of non-prismatic enamel, resistant to carious because it is less soluble in acid.^[6,7] This explains why the occurrence of NCCL is more frequent than carious in this area.

The appearance of the lesions varies from shallow depressions, broad disk-shaped lesions to large wedge-shaped defects. The floor of the lesion may be flat, indented, or sharply angled.^[8] Regarding on the location, numerous investigations have confirmed the greatest frequency of NCCL from the canine to the first molar and among them, particularly on the premolars.^[9-10] Donachie and Walls reported that in the

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mandible, the premolars showed a greater degree of cervical wear than the molars, and in the maxilla, the first molars had the greatest degree of wear up to 65 years of age, followed by the premolars.^[11]

Oral health providers have been aware of NCCLs for a long time. Besides that, the lesions are becoming an increasingly important factor when considering the long-term health of the dentition. In fact, the occurrence of this condition is steadily increasing. All studies found an increased prevalence with age, whereby older individuals have a greater number of lesions than younger people and the lesions tend to be larger.^[12-13] In general, the prevalence of tooth wear is considered high, especially in older population, which also includes NCCL. In a study done by Smith WA *et al.*, in 2008, showed that 156 patients attending university hospital in Trinidad with a mean age of 40.6 years were examined of whom 62.2% was affected with NCCLs.^[14] Another study done by W Yan *et al.*, 2014, about 72.5% of people in Guangzhou area were affected with NCCLs, with a higher percentage affecting those people aging >40 years.^[15-16] While in Malaysia, only a small number of research done on tooth wear, Class V restoration, and its survival rate. There is still no study done on the prevalence of NCCLs; however, there was one study by RWR Daly *et al.*, 2010, with adults in Kelantan, Malaysia, which among 81 people who had tooth wear, none of them NCCLs.^[17]

The etiology of NCCLs is due to occlusal force, erosive agents, and mechanical abrasion due to intense tooth brushing. However, a systematic review was unable to determine any specific etiological factors for NCCLs due to the risk of bias and other confounding factors in the literature available.^[4-18] Unfortunately, although NCCL restorations are a very common occurrence in clinics, they also represent one of the less durable types of restorations. Despite these restorations being a continuing problem in restorative dentistry, the causes of the diminished longevity are still poorly understood.

There are no generally accepted, specific guidelines in the literature stating that all lesions should be restored. Logic and good clinical judgment would suggest that they should be restored when clinical symptoms such as dentine hypersensitivity have developed or are likely to develop in the near future. Esthetic demands of the patient may also influence the decision to restore these lesions.^[19] There are considerable challenges for the dentist to restore NCCLs. A critical factor for restorative challenges is represented by the selection of the restorative materials as well as technique used by the clinicians. At present, the materials of choice indicated for restoring cervical lesions include glass ionomer cements (GICs), resin-modified GIC (RMGIC), polyacid-modified resin-based composite (compomer), and composite resins. There is a significant body of literature, which documents the influence of restorative material toward the longevity of

cervical restorations. Clinical studies have shown repeatedly that restoration of NCCL has inadequate retention rates, with higher percentage of failure at the cervical, compared with the occlusal restorations. Cervical restorations represent one of the less durable types of restorations and have a high index of loss of retention, marginal excess, and secondary caries. Some of the possible causes for these problems include difficulties in isolation, insertion, contouring, and polishing procedures.^[20]

Hence, the purpose of this study was to assess the clinical performance of NCCLs restoration done in Universiti Sains Islam Malaysia's (USIM) dental clinic. A secondary purpose was to compare the clinical performance of various types of restoration materials used and to identify the effect of clinical handling technique toward the success of the restorations.

MATERIALS AND METHODS

This is a cross-sectional study done on patients' whom undergone restoration on NCCLs at USIM's Dental Clinic from August 2009 to August 2016. The inclusion criteria are restoration done on permanent teeth which involve patients over 20 years of age with fair oral hygiene.

Ethical approval was obtained and the list of patient that has NCCLs was obtained from the students' log books. Patients were selected by non-probability sampling based on the inclusion and exclusion criteria. The treated or restored NCCL was noted from patients' folders alongside with the technique and materials used were collected. Intraexaminer calibration was carried out before review of patients and a number of samples were called to the clinic for an evaluation of the restored lesion, and consent was taken from the patients. The restorations were clinically evaluated by one investigator according to the modified United States Public Health Service (USPHS) criteria (Ryge, 1980). The result outcome with Alpha and Bravo is considered acceptable, while a result with Charlie is considered unacceptable and recommended for retreatment. Then, patient was informed and advised on the management of the failed restoration.

The data collected was analyzed using the Statistical Package for the Social Sciences Version 21.0. The outcome determined the statistical significance on the survival rate of the restorations (acceptable or unacceptable) based on its association with materials and clinical handling technique was assessed using the Chi-square test.

RESULTS

Surveyed group and case distribution

Data for 121 NCCLs restorations were collected from 34 patients. 77 patients (63.6%) were male and 44 patients (36.4%) were female. The range of patient's age is from 30

to 70 years old. The lifespan of the restorations was from 1 to 8 years. Among the restoratives used for NCCLs, GIC ($n = 77, 63.6\%$) was the most frequently used followed by RC ($n = 22, 18.2\%$) and RMGIC ($n = 22, 18.2\%$). The technique used for NCCLs for without cavity preparation ($n = 90, 74.4\%$) is higher than restoration with cavity preparation using rotary instruments ($n = 31, 25.6\%$).

The comparison of clinical performance between GIC, RC, and RMGIC

The number of GIC restorations that were evaluated as clinically acceptable (Alpha or Bravo) according to modified USPHS criteria was significantly higher than RC and RMGIC. More than half of GIC restorations were evaluated as clinically acceptable, while for RC, it has equal percentage of acceptable and acceptable restoration and more than half of RMGIC was rated as clinically unacceptable (Charlie or Delta). It was shown that there is a significant difference in the clinical performance between the three types of materials used with $P = 0.021$. In the criteria of retention and secondary caries, there is a significant difference with the type of materials used ($P = 0.027$ and $P = 0.021$, respectively; $P < 0.050$). Meanwhile, there is no significant difference in the marginal integrity, marginal discoloration, and anatomic form with the type of materials used. Table 1 shows the data collection for GIC, RC, and RMGIC.

The comparison of clinical performance between cavity preparation using rotary instrument and without cavity preparation

Between the two technique used, it was shown that there is no significant difference between the technique used ($P = 0.083$). Table 2 shows the data collection of different clinical handling used.

DISCUSSION

In total, GIC (63.6%) was used 3 times more frequently than RC and RMGIC. Selection of GIC is high due to adhesion capability to tooth structure and easy handling.^[21,22] Most laboratory studies suggested GIC as the restorative material of choice for cervical lesions due to clinically acceptable interfacial gaps, its capacity for absorbing occlusal load and the low polymerization shrinkage stress of slowly setting glass ionomers.^[23,24] In another study, GIC was recommended as the material of choice for high caries risk patient due to its *in vitro* fluoride release.^[25] The result of the current study is accordance to the previous study since GIC is superior to RC and RMGIC in terms of secondary caries. However, other studies stated that RCs are the most frequently selected material for cervical restorations due to its esthetic excellence and adequate mechanical properties.^[26,27]

In our study, GIC has better retention rate than RC and RMGIC. It is supported by the study done by Powell

Table 1: The comparison of clinical performance between GIC, RC, and RMGIC

Materials of restoration	Clinical performance	Retention (%)	Marginal (%)	Marginal discoloration	Anatomic form (%)	Secondary caries (%)
		$P=0.027$	integrity $P=0.179$ (n)	(n) discoloration $P=0.134$ (n)	$P=0.235$ (n)	$P=0.021$ (n)
GIC	A and B (acceptable restoration)	75.3 (58)	81.8 (63)	81.8 (63)	76.6 (59)	85.7 (66)
	C and D (unacceptable restoration)	24.7 (19)	18.2 (14)	18.2 (14)	23.4 (18)	14.3 (11)
RC	A and B (acceptable restoration)	63.6 (14)	72.7 (16)	68.2 (15)	77.3 (17)	72.7 (16)
	C and D (unacceptable restoration)	36.4 (8)	27.3 (6)	31.8 (7)	22.7 (5)	27.3 (6)
RMGIC	A and B (acceptable restoration)	45.5 (10)	63.6 (14)	63.6 (14)	59.1 (13)	59.1 (13)
	C and D (unacceptable Restoration)	54.5 (12)	36.4 (8)	36.4 (8)	40.9 (9)	40.9 (9)

RMGIC: Resin-modified glass ionomer cements, GIC: Glass ionomer cements

Table 2: The comparison of clinical performance between cavity preparation using rotary instrument and without cavity preparation

Clinical handling technique	Clinical performance	Retention (%) (P=0.824) (n)	Marginal integrity (%) (P=0.630) (n)	Marginal discoloration (%) (P=0.810) (n)	Anatomic form (%) (P=0.479) (n)	Secondary caries (%) (P=0.612) (n)
Restored with cavity preparation	A and B (acceptable restoration)	71.0 (22)	80.6 (25)	74.2 (23)	67.7 (21)	74.2 (23)
	C and D (unacceptable restoration)	29.0 (9)	19.4 (6)	25.8 (8)	32.3 (10)	25.8 (8)
Restored without cavity preparation	A and B (acceptable restoration)	66.7 (60)	75.6 (68)	76.7 (69)	75.6 (68)	80.0 (71)
	C and D (unacceptable restoration)	33.3 (30)	24.4 (22)	23.3 (21)	24.4 (22)	20.0 (80)

stated that GIC material has better retention rates than the composite material in Class V restoration.^[28] The low retention rate of RC is possibly due to degradation of adhesive bond.^[29] Other than that, it is due to the results of increase in the amount of sclerotic dentine in Class V lesions in older patients which resists the etching procedure needed for dentin bonding.^[30] Other studies, with prospective longitudinal designs for relatively short durations, reported that glass ionomer-derived materials, especially RMGIC had better retention rate than RC.^[31] It was contradicted with the study done by Namgung that stated RC demonstrates superior clinical performance than GIC in retention, marginal discoloration, and marginal adaptation.^[32] However, most studies have reported no difference in the retention of cervical restorations among RC and RMGIC.^[33,34]

In terms of clinical handling technique, this study shows that there is no significant association between the clinical performance of the restoration and the preparation of the cavity. Although our study shows no difference of clinical performance of NCCLs restored with cavity preparation using rotary instruments and without cavity preparation, Stewardson suggested that preparation for NCCL using rotary instruments is beneficial to improve survival rate of restoration.^[35,29] When placing GIC restoration, preparation of cavity margin is necessary to allow adequate bulk for this brittle material.^[36] Although GIC might be expected to bond more effectively to the increased mineral content of sclerotic dentine, it will subject to edge failure if the cavity is not prepared to allow the glass ionomer to be of adequate thickness at the margins to compensate for its low fracture strength. Other views also recommended to carry out cavity preparation for RC because it will provide mechanical retention and the roughening the surface is advisable to remove superficial sclerotic dentine to which current composite bonding methods are less effective.^[37]

After we have carried out the research, we noticed that there are few limitations that we need to address. First, improper records related to the clinical handling technique recorded in patient's folder contributed to the unsatisfactory result. This definitely makes the data collection became challenging. In this study, the number of groups in each variable was minimized as much as possible because too many groups would produce higher order interaction and complicate the interpretation of the results. Second is small sample size due to high number of patients. A small sample size may also increase type II errors and decrease statistical power.^[38,39] Due to all the limitation factors, our recommendation is every academic institution must have very good information and detailed patients' records because this will ease the data collection process. Next is to increase the sample size and we also suggest to conduct a clinical trial research so that all the modifying factors can be controlled and the results can be analyzed accordingly.

CONCLUSION

The clinical performance of NCCL restoration based on the types of material was statistically different, where GIC demonstrated superior clinical performance to RC and RMGIC in the criteria of retention and secondary caries. However, there is no significant difference in the clinical performance of NCCL restorations done with different clinical handling technique.

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How to cite this article: Fatah FA, Al-Kadhim AHA, Norazlina M, Amalina AA, Aqila D, Amirah BN. An Assessment on the Clinical Performance of Non-Carious Cervical Restorations. *J Clin Res Dent* 2018;1(2):1-6.