



RESEARCH ARTICLE

ONE YEAR COMPARATIVE EVALUATION OF CLINICAL PERFORMANCE OF SILVER AMALGAM AND CENTION-N IN SIMPLE CLASS I CARIOUS LESIONS IN PERMANENT MOLARS – A SPLIT MOUTH RANDOMIZED CLINICAL STUDY

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ABSTRACT

Aim: To compare and evaluate the clinical performance of Silver Amalgam and Cention-N in simple class I carious lesions in permanent molars. **Methodology:** After ethical approval, Patients were selected as per inclusion and exclusion criteria and Class I cavity preparation was done under rubber dam isolation and randomly divided into two groups. In Amalgam group, deep lesions were managed by application of Dycal and zinc phosphate base and restored with silver amalgam. In Cention-N group, deep lesions were treated by application of Dycal followed by Cention-N restoration. Carving was done followed by finishing and polishing. Evaluation was done at 1 week, 6 months and 1 year time interval by examiner other than operator according to modified USPHS criteria. The results of the study were tabulated and statistical analysis was done. **Results:** There was no statistically significant difference in the clinical performance of Silver Amalgam and Cention-N in Class I carious lesions at the end of 1 week, 6 months and 1 year. **Conclusion:** Both materials showed equal and acceptable clinical performance at the end of one year. Cention-N should be preferred as an alternative to amalgam in simple class I lesions.

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INTRODUCTION

Dental amalgam has been viewed as an excellent and versatile restorative material to be used in dentistry and served as a dental restoration for more than 165 years (Rathore, 2012). In practice however, dental amalgam is a technique-insensitive, cost-effective material and its long term clinical performance is exceptional. Anusavice reports that approximately 90% of amalgam restorations are still functional after 10 years and

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posits that this may be due to their tendency to minimize marginal leakage, despite not adhering to tooth structure. This could be due to corrosion products that form along the interface between the tooth and the restoration, essentially sealing the interface and preventing leakage (Anusavice, 2003). But as every coin has two sides; amalgam's popularity as a restorative material has been decreasing these days due to concerns about aesthetics, more biologic loss of tooth, environmental pollution caused by mercury and detrimental health effects (Bharti et al., 2010). However due to wide media discussion of biocompatibility issues and mercury in general, the suitability of this material is often questioned by patients as well as dentists. Current European and international authority concerns, lie largely with the toxicological burden on the environment due to mercury and less with patient-safety

issues. A gradual phasing out of amalgam however is largely supported and inevitable, thus alternative basic filling products are long overdue (Todd, 2016). Dentists have long sought after a real alternative to amalgam or glass ionomer cements – a cost-effective, fluoride releasing product that is quick and easy to use without complicated equipment and that offers both strength and good esthetics (Todd, 2016). Cention-N, a new filling material offering these characteristics plus other advantages over both amalgams and glass ionomer cements. It is an “alkasite” restorative material which like compomer or ormocer materials, is essentially a subgroup of the composite material. This category utilizes an alkaline filler, capable of releasing acid-neutralizing ions. It is a tooth-colored, dual-cure material for restoring deciduous teeth and for permanent restorations of a Class I, II or V nature. It may however be used with or without an adhesive. No etching is carried out when used without an adhesive. If without, then retentive preparation (with undercuts) similar to that used in amalgam fillings is required and enamel margins should not be bevelled. If it is used with an adhesive then the cavity is prepared according to the modern principles of minimally invasive dentistry (Anusavice, 2003; Todd, 2016). Hence the study was aimed to compare the clinical performance of Cention-N and amalgam in class I carious molars for a period of one year. The null hypothesis was that there will be no difference between clinical performance of silver amalgam and Cention-N in class I carious lesions using modified USPHS criteria for one year.

METHODOLOGY

Prior permission from the institutional ethics committee(SVEIC/ON/Dent/SRP/17020) was taken and patients with at least two class I caries in molar teeth were included and the written informed consent was obtained. Each of them received a pair of class I restoration. Inclusion criteria were: patients with vital permanent molars having minimum 2, one on each side of the mouth, class I primary carious lesions having no symptoms of irreversible pulpitis and in occlusion with antagonistic teeth. General exclusion criteria were: poor oral hygiene, severe or chronic periodontitis, heavy bruxism, and a known allergic reaction to any of the components of the materials used. Specific exclusion criteria were: Non vital, fractured or visibly cracked teeth, defective restorations adjacent to or opposite the tooth, rampant caries and atypical extrinsic staining of teeth. After selection, the patients that were ready to sign the consent were included. Sample size was calculated using $N = \frac{CHISQAURE}{W^2}$ formula. Total 25 patients in each group were selected but to compensate the dropout of 20%, a total of final 30 patients in each group were taken.

After administration of local anesthetic agent(nirlife) with 1:80000 epinephrine via infiltration anesthesia for maxillary and inferior alveolar nerve block for mandibular teeth, the Class-I cavity was prepared according to the basic designs of cavity preparation, using an airtorhandpiece and dental burs(Mani Inc.)under a water cooled spray. Deep caries were excavated using spoon excavator(Hu-friedy). After excavation, the teeth were isolated using rubber dam(Hygiene Co.). In deep caries pulp protection was done using Dycal and then the teeth were randomly divided into the two experimental groups by flip coin randomization method.

Group 1: Silver Amalgam(n=30): After cavity preparation, zinc phosphate cement(Harvard) in thickness of 0.5-1 mm was applied as a base.

Then low copper amalgam (DPI) was placed, condensed and carved. After the placement of the restoration, the patient was recalled after 24 hours for post-carve burnishing and after 1 week for polishing of the restoration.

Group 2: Cention-N (n=30): After cavity preparation, Cention-N material was handmixed with the help of agate spatula in the liquid/powder ratio of 1:4.6(According to manufacturer’s instructions). After Mixing, the material was placed into the cavity within 2-3 minutes and condensed by Teflon coated instruments to remove voids. Finally, restoration was carved followed by finishing and polishing. After placement of restoration, evaluation was done by the investigator other than operator by using modified USPHS criteria for 1 week, 6 months and 1 year. The data was then collected and statistically analyzed by SPSS software 18.00.

RESULTS

Each patient received a minimum of two restorations, one with each material. The restorations were evaluated for retention, color match, marginal discoloration, marginal adaptation, secondary caries, anatomic form and post-operative sensitivity according to modified USPHS criteria. Of the 30 patients treated, 7 were male, while 23 were female. The follow up considered in the study was 1 week, 6 months and 1 year. At 1 week and 6 months evaluation, all the patients were available for the follow up. At 1 year time interval, 2 out of 30 patients did not turn up for the follow up (Table 1).

Silver Amalgam: All restorations gave alpha scores for all the criteria except for color match for which all the restorations gave Charlie score for 1 week, 6 months and 1 year.

Cention N: At 1 week and 6 months all the restorations gave alpha score for all the criteria. However at 6 months two restoration and at 1 year one restoration gave bravo score for marginal discoloration while rest all the restorations gave alpha scores. As the values were constant for all the two materials, the p value was not possible and hence there wasn’t any statistically significant difference at the end of 1 year.

The statistical analysis of the results of the present study showed no statistically significant difference in the clinical performance of silver amalgam and Cention-N in terms of retention, color match, marginal discoloration, marginal adaptation, secondary caries, anatomic form and post-operative sensitivity in Class I carious lesions at the end of 1 week, 6 months and 1 year.

DISCUSSION

Dental amalgam is one of the most versatile restorative materials used in dentistry and served as a restoration for more than 165 years. There is still no adequate economic alternative for amalgam. It has a myriad of uses: rather low technique sensitivity, self-sealing property, low cost, bacteriostatic effect, longevity in stress bearing areas and foundation for cast-metal and ceramic restorations. Besides all, if placed under ideal conditions, it is more durable and long lasting and least technique sensitive of all restorative materials, but, concern has

been raised that amalgam causes mercury toxicity. The main exposure to mercury from dental amalgam occurs during placement or removal of restoration in the tooth.

it can be used as a full volume (bulk) replacement material. Optional light curing is carried out with blue light in the wavelength range of approximately 400–500 nm.

Table 1. Clinical Performance of Silver Amalgam and Cention-N at baseline, 6 months and 1 year

Evaluation criteria		Silver Amalgam			Cention-N		
		Baseline No. of Patient	6 months	1 year	Baseline No. of Patient	6 months	1 year
1 Retention	A*	+	+	+	+	+	+
	B*	-*	-	-	-	-	-
	C*	-	-	-	-	-	-
2 Color Match	A	-	-	-	+	+	+
	B	-	-	-	-	-	-
	C	+	+	+	-	-	-
3 Marginal discoloration	A	+	+	+	+	28	27
	B	-	-	-	-	2	1
	C	-	-	-	-	-	-
4 Marginal Adaptation	A	+	+	+	+	+	+
	B	-	-	-	-	-	-
	C	-	-	-	-	-	-
5 Secondary caries	A	+	+	+	+	+	+
	C	-	-	-	-	-	-
6 Anatomic form	A	+	+	+	+	+	+
	B	-	-	-	-	-	-
	C	-	-	-	-	-	-
7 Post-operative sensitivity	A	+	+	+	+	+	+
	B	-	-	-	-	-	-
	C	-	-	-	-	-	-

*A – Alpha, B – Bravo, C – Charlie, + = Positive, - = Negative

Once the reaction is complete less amount of mercury is released and that is far below the current health standard. An international treaty to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds, 140 countries agreed in the Minamata Convention on Mercury phase out by the United Nations Environment Programme (UNEP). So, it is necessary that newer material should be mercury free and have a property like amalgam and aesthetic like glass ionomer cement or composite (Rathore, 2012; Anusavice, 2010; Bharti *et al.*, 2010). The performance of dental restorations is influenced by several factors, including the restorative materials used (Mjör *et al.*, 1993; Mjör, 1998; Mair, 1998), the clinician's level of experience (Mjör *et al.*, 2000), the type of tooth (Johnson *et al.*, 1992; Norman, 1990), the tooth's position in the dental arch (Drake, 1988; Kolker, 2004), the restoration's design (Jokstad, 1991), the restoration's size, the number of restored surfaces and the patient's age (Lucarotti *et al.*, 2005; Wahl *et al.*, 2004). Posterior resin composite restorations have considerably gained popularity over the past decade. Recent advances in adhesives and restorative materials together and simplification of procedures have increased the use of composites in posterior region. They have become a preferred alternative to amalgam restorations in terms of function and aesthetics. But composites have several disadvantages like: time-consuming, technique sensitive, cost-effective, discoloration with time, longevity, secondary caries and post-operative sensitivity etc (Mjör, 1993; Johnson, 1992; Norman *et al.*, 1990). A retrospective study comparing posterior composite and amalgam restorations placed in a general dental practice found no differences in longevity, but observed relatively more secondary caries in relation to composite and more fracture failures related to amalgam restorations (Opdam *et al.*, 2007). Cention-N, a new filling material offering advantages of both amalgams and glass ionomer cements. It is a basic, resin-based, self-curing powder/liquid restorative with optional additional light-curing. It is radiopaque, and releases fluoride, calcium and hydroxide ions. As a dual-cured material

This alkasite Cention-N redefines the basic filling, combining bulk placement, ion release and durability in a dual-curing, esthetic product - satisfying the demands of both dentists and patients (Todd, 2016). The organic monomer is found in the Liquid. It consists of four different dimethacrylates which represent 21.6% wt. of the final mixed material. A combination of UDMA, DCP, an aromatic aliphatic-UDMA and PEG-400 DMA, interconnects (cross-links) during polymerization resulting in strong mechanical properties and good long-term stability. It does not contain Bis-GMA, HEMA or TEGDMA. The filler is found in the Powder. The inorganic fillers comprise a barium aluminium silicate glass filler, ytterbium trifluoride, an Isofiller (Tetric N-Ceram technology), a calcium barium aluminium fluorosilicate glass filler and a calcium fluorosilicate(alkaline) glass filler, with a particle size of between 0.1 µm and 35 µm. This Isofiller, acts as a shrinkage stress reliever which minimizes shrinkage force. The compressive strength of Cention-N is almost similar to silver amalgam (Todd, 2016). It is available in A2 shade only because this is commonly used shade and chameleon effect further increased the color matching of restoration with tooth. Glass ionomer cements have proved to decreased aesthetic property when compared with the composite materials. Still with the advancement and introduction of Cention-N has tried to overcome the problem of aesthetics (Todd, 2016). Class I carious lesions are the most widely and commonly found condition in the patients. An important factor to be considered in Class I lesions is the C factor. Class I cavities have the C factor ratio of 5:1, wherein only one free surface is present for release of stresses. Also, the Class I cavities in posterior teeth are the primary stress bearing areas during mastication or various movements. Also, clinical performance of restorative materials can be successfully checked in class I lesions. Hence, Class I cavities including only the occlusal surface were included in the study (Mahmoud, 2014). In the present split mouth study, 30 subjects having a minimum of two lesions were included. The distribution was done in accordance to the guidelines by ADA

and FDI recommendations. Allocation of the lesions to each restorative material was randomly done in order to eliminate any bias in the selection. Randomization was done by flip coin randomization method which is one of the most common methods of simple sampling (Suresh, 2011). For clinical evaluation the combination of the original and modified USPHS criteria now has been accepted worldwide. The modified USPHS criteria include the following parameters: Retention, Color match, Marginal discoloration, Marginal adaptation, Secondary caries, Anatomic form, Post-operative sensitivity (Wayne, 2005). The results of the study did not show any statistically significant difference amongst the two restorative materials. So, the null hypothesis is not rejected. Clinically, both the materials showed equal and acceptable performance at the end of one year. Hence long term clinical studies with larger sample size should be done for further acceptable and reliable results.

Conclusion

Under the limitations of the study, there was no statistically significant difference seen in the clinical performance of Silver Amalgam and Cention-N and both materials shows equal and acceptable clinical performance at the end of one year. Cention-N should be preferred as an alternative to amalgam in class I lesions.

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