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Effects Of 20% Bleaching Agent on Surface Roughness of Restorative Materials-An In Vitro Study.

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Abstract : *The purpose of this study was to determine the effect of different irrigating solutions on mercury released from dental amalgam.* ***Method and materials:*** *Thirty samples of dental amalgam of similar size were prepared and exposed to a 10-ml solution of either 3% naocl, 17% EDTA, combination of 3% naocl + 17% EDTA solution,2% chlorhexidine, 3% naocl + 2% Chlorhexidine solution, saline solution-controlgroup. For periods of 60 minutes. Mercury concentrations in the solutions were measured by using a cold-vapor atomic absorption Mercury Analyzer System, and the differences between the groups were statistically analyzed.****Results****-All amalgam samples exposed to 3%naocl , 17% EDTA ,combination of 3% naocl + 17% EDTA , 2% Chlorhexidine solution, 3%naocl + 2%chlorhexidine solution and saline (control) released mercury into solutions. Mercury released was significantly higher in naocl group (3.01) & EDTA + naocl (1.08) as compared to the other test solutions chlorhexidine + naocl (0.6), EDTA (0.29) chlorhexidine (0.24) & saline (0.24) . Chlorhexidine does not show any difference in mercury release with saline (control group).****Conclusions.*** *Naocl solutions commonly used for root canal cleaning and shaping cause mercury release from dental Amalgam and may alter its chemo-physical properties as a sealant for root perforations*
.***Keywords:*** *Mercury release, Dental Amalgam, Chlorhexidine, EDTA,Hypochlorite*

I. INTRODUCTION

Maintaining the integrity of natural dentition is essential for full function and natural esthetics. Endodontic therapy can play vital role in achieving this goal. Undesirable clinical complications may occur during endodontic procedures one of these complications is root perforation which occurs pathologically due to resorption and caries or iatrogenically during root canal treatment. This can significantly impact the long term prognosis of tooth. When left untreated, perforation of pulpal floor results in an inflammatory response in the supporting tissue, with epithelial proliferations and eventual periodontal pocket formation (Lantz and Pearson 1967, Bhaskar and Rappaport 1971, Jew et al 1982).[1]

Treatment prognosis of root perforation depends on several factors such as location, size, time of diagnosis and treatment, and degree of periodontal damage, as well as the sealing ability and biocompatibility of the repair material.[1-7]

It has been recognized that treatment success depends mainly on immediate sealing of the perforation and appropriate infection control. Several materials have been recommended to seal root perforations, including, among others, Cavit, immediate restorative material, Super EBA, mineral trioxide aggregate, glass ionomer cements, composites, and amalgam.[8-14]

Although several studies have demonstrated certain disadvantages in using amalgam for sealing radicular perforations, it appears that this traditional material is still widely used. NaOCl is the most popular chemical agent used for intracanal irrigation during endodontic therapy.[15]

Its concentration for clinical use varies from 0.5% to 5.25%. A 2.5% solution is commonly recommended. NaOCl has an effective antimicrobial action and is capable of dissolving pulpal tissues, as well as removing debris from the root canal. When used in combination with a chelating agent such as EDTA it enables the removal of organic and inorganic smear layer.[16,17]

In previous studies it was found that amalgam exposure to certain oxidizing agents caused an increase in mercury levels on its external surfaces, [18]. as well as higher mercury release into solution[19].It is hypothesized that mercury released from amalgam during the chemomechanical phase of root canal cleaning and shaping may

affect the metallurgic charecteristics of of amalgam when used to repair root perforations. In addition, it may induce leaching of toxic mercury to the adjacent periradicular tissues. The effect of NaOCl solutions on dental amalgam with respect to root perforations showed greater mercury release in NaOCl as compared to EDTA[20].
But the effect of Chlorhexidine and combination of chlorhexidine and NaOCl on mercury release has not been studied.

The purpose of this study was to investigate the interaction between amalgam and established chemical agents used for cleaning and shaping of the root canal system.

Aims and objectives:-

The aim of this in vitro study was to compare the effect of 3% NaOCl, 17% EDTA, combination of 3% NaOCl + 17% EDTA solution, 2 % Chlorhexidine and combination of 2%chlorhexidine and 3% NaOCl solution on mercury release from dental amalgam.

II. METHOD AND MATERIALS

Thirty samples of high-copper dental amalgam (DPI Alloy ,fine grain dental products of india Pvt.Ltd.India) were prepared as previously described by Rotstein et al.[18] Briefly, the amalgam capsules, each containing 600 mg of alloy and 536 mg of mercury, were automatically mixed in a dental amalgamator (Dentomax compat ,Degussa Huls Dental Ltd. Brazil). The freshly prepared mix was then condensed into silicon embedding molds with similar 10 × 5 × 3-mm cavities by using handheld amalgam condensers. The samples were left for initial setting in the molds for 60 minutes and then removed and immersed in saline solution. Seventy-two hours later, the amalgam samples were rinsed with distilled water, dried at room temperature, and randomly divided into 6 (5 experimental and 1 control groups) of 5 samples each. Each experimental sample was sealed in an individual glass assay tube containing a 10-mL solution of either 3% NaOCl, 17% EDTA, combination of 3% NaOCl + 17% EDTA solution,2% chlorhexidine, 3% NaOCl + 2% Chlorhexidine solution, saline solution-controlgroup. The assay tubes containing the amalgam samples were incubated at 37°C for period of 60 minutes. Mercury levels of each solution were measured by using the MAS-50D Mercury Analyzer System (Model No.MA 5800E,ECIL,Hyderabad). The chemical reaction of the Mercury Analyzer System is based on the cold-vapor atomic absorption method developed by Hatch and Ott.1968[21]. Briefly, the tested solution was treated with nitric and sulphuric acids in the presence of potassium permanganate and potassium persulfate to oxidize all the mercury present to mercuric ions (Hg++). Any excess oxidant was neutralized with hydroxylamine hydrochloride. The mercury in the solution was then reduced to metallic mercury by the addition of stannous chloride solution. An internal pump circulating air, in a closed-loop system, through the solution evaporated the mercury, carrying it through the absorption cell. The mercury vapor present in atomic form absorbs light at 253.7-nm wavelength, and the change in energy transmitted through the cell is detected by a UV-sensitive phototube. Mercury concentration for each of the solutions tested was determined by comparing it with a standard curve of known amounts of mercury. Mercury concentrations of each solution of the tested amalgam samples were recorded, and the differences between the means of each experimental and control group were statistically analyzed by using the Analysis of Variance and the Mann-Whitney *U* test .

III. FIGURES AND TABLES GRAPH-1-EFFECT OF DIFFERENT IRRIGATING SOLUTION ON MERCURY RELEASED FROM AMALGAM

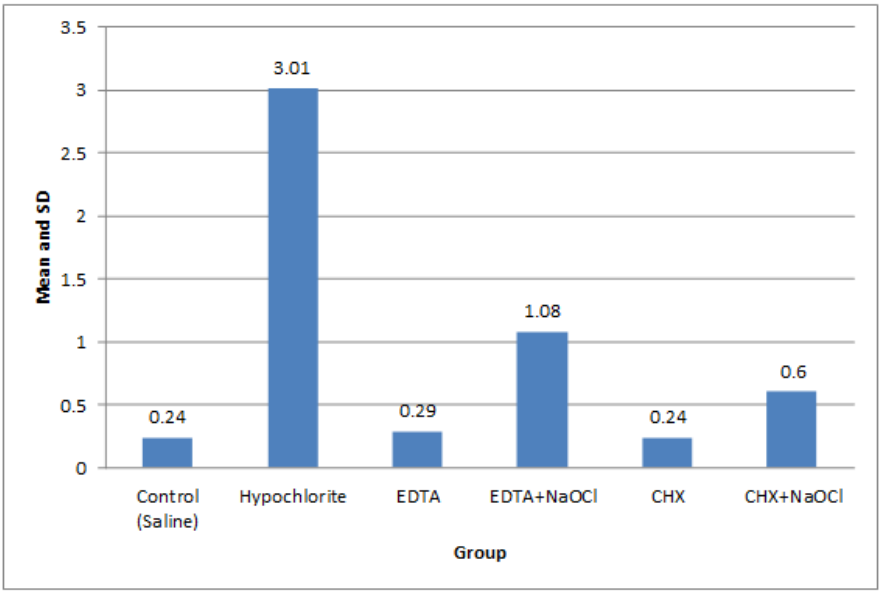

TABLE-1EFFECT OF DIFFERENT IRRIGATING SOLUTION OF MERCURY RELEASED FROM AMALGAM

Group	N	Mean	Std. Deviation	Std. Error	95% confidence interval for mean		Minimum	Maximum
					Lower bound	Upper Bound		
Control (Saline)	5	0.24	0.02	0.009	0.22	0.27	0.22	0.28
Hypochlorite	5	3.01	0.01	0.005	3.00	3.03	3.00	3.03
EDTA	5	0.29	0.02	0.013	0.26	0.33	0.25	0.32
EDTA+NaOCl	5	1.08	0.08	0.037	0.97	1.18	1.00	1.20
CHX	5	0.24	0.11	0.050	0.09	0.38	0.10	0.40
CHX+NaOCl	5	0.60	0.15	0.070	0.40	0.79	0.40	0.80

IV. RESULT

All amalgam samples exposed to 3%NaOCl , 17% EDTA ,combination of 3% NaOCl + 17% EDTA , 2% Chlorhexidine solution, 3%NaOCl + 2%chlorhexidine solution and saline (control) released mercury into solutions. (table -1) (graph - 1)

Mercury released was significantly higher in NaOCl group (3.01) & EDTA + NaOCl (1.08) as compared to the other test solutions chlorhexidine + NaOCl (0.6), EDTA (0.29) chlorhexidine (0.24) & saline (0.24).

Chlorhexidine does not show any difference in mercury release with saline (control group).

V. DISCUSSION

Our results indicate that exposure of dental amalgam to NaOCl may cause mercury release into the surrounding medium. Therefore, amalgam used to repair root perforation may be a source of continuous mercury release when 1% to 3% NaOCl solutions are being used for canal irrigation. Mercury release was found to be time-dependent. This effect was also observed in a previous study in which dental amalgams were exposed to other oxidizing agents.[18] A positive correlation between NaOCl concentration and mercury release was also found. An increase in NaOCl concentration from 1% to 3% practically doubled the amount of mercury in solution for each of the corresponding time periods. A similar pattern was found in a previous study in which amalgam was exposed to a different oxidizer.[19] The mechanism by which NaOCl causes mercury release from dental amalgam is not completely clear. NaOCl solution is a pentahydrate usually prepared from NaOH and Cl2 in the presence of water. It contains 47.62% chlorine, 30.88% sodium, and 21.49% oxygen. NaOCl solutions release hypochlorous acid, which can cause oxidation and corrosion of amalgam. This may be due to the strong oxidative reaction of the OCl– ion released from NaOCl. It is, therefore, proposed that NaOCl may have

accelerated the degradation of amalgam surfaces by removing its protective surface films and exposing the silver-mercury matrix. The unprotected amalgam surface was then further oxidized, resulting in chemical dissolution of the mercury-rich gamma 1 matrix phase and diffusion of available mercury to the surrounding solution. Higher concentrations of NaOCl may have exposed more of the silver-mercury matrix, indicated by the positive correlation between NaOCl concentrations and mercury levels in solution.

Care must be taken while performing canal irrigation to prevent inadvertent extrusion of dissolved mercury beyond the apical foramen and into the periapical tissues. It is reasonable to believe that NaOCl solutions that make contact with amalgam will contain mercury as a contaminant. Therefore, careful irrigation techniques in such cases will ensure that only minimal amounts of the NaOCl solution will be extruded beyond the apical foramen.[22,23] When EDTA was added to NaOCl, a significant reduction in detectable mercury in solution was evident. EDTA is a chelating agent commonly used in medicine.[24] In endodontics it is mainly used for removal of smear layer, dentin softening, and to facilitate the removal of calcific obstructions within the root canal. Its chelation action is achieved by the incorporation of a metal or metaloid ion into heterocyclic ring structure.[25] EDTA forms stable complexes with many of the essential metals, as well as with some toxic metals, including mercury.[24] It can, therefore, be assumed that EDTA formed a stable chelate complex with mercury released from the amalgam exposed to NaOCl solutions and thus caused the bound mercury to not be detected by the cold-vapor mercury analyzer. CHX is a synthetic cationic bis-guanide consists of two symmetric 4-cholorophenyl rings and two biguanide groups connected by a central hexamethylene chain. [26] There is no difference in release of mercury ions in Chlorhexidine group as compare to saline. When trying to extrapolate our results to clinical conditions, the fact that the size of the amalgam samples used in this study was larger than the usual amalgam size used to seal root perforations must be taken into consideration. It is reasonable to believe that a smaller amalgam surface area exposed to NaOCl will yield a lower amount of mercury in solution. In addition, the amalgam samples used here were exposed to the test solutions 72 hours after setting. No measurements were made to determine the amount of mercury released from freshly prepared amalgam. There is no clear indication in the literature with respect to when root canal treatment should be resumed once the perforation is sealed. Some clinicians proceed to clean and shape the root canal system immediately after perforation repair, whereas others prefer to delay the procedure for another appointment. In both cases, however, NaOCl will make contact with the repair material for periods up to 1 hour and possibly affect its reparative efficacy. However, this was not tested in the present study. With respect to the action of EDTA, it must be taken into consideration that under in vivo conditions, the stability of a metal chelate may be affected by its stability constant, pH, competition by other metal ions and ligands, tendency of the metal to form insoluble hydroxides, distribution and metabolism of the chelate, and competition of endogenous biochemicals for complexing the metal ion. In our study the interaction between EDTA and the other metallic components of amalgam was not determined. Such interaction may affect the availability of a specific concentration of EDTA to all mercury present. EDTA is capable of chelating other metallic byproducts of dental amalgam, such as copper, which may be released from corroded amalgam and thus affect the total amount of mercury chelated in the solution. This merits further investigation.

VI. CONCLUSION

Naocl solutions commonly used for root canal cleaning and shaping cause mercury release from dental Amalgam and may alter its chemo-physical properties as a sealant for root perforations.

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