Effect of in-dental clinic bleaching agents on the releases of mercury from the specimen of amalgam restoration in relation to their times intervals

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ABSTRACT

Background: Measuring the effect of bleaching agents on mercury release from dental amalgam is important from both restorative and toxicological points view. The aims of the study was to evaluate the effects of two different types of bleaching agents for vital teeth by using with light source on the release of mercury from the specimen of amalgam restoration .

Materials and methods: Fifty three specimen of amalgam restoration, were subject to treated with bleaching agents (35% hydrogen peroxide and carbamide peroxide) and then application of light and laser radiation to activate the bleaching agents. Flameless atomic absorption spectrophotometer with Gold Vapor Generator was used to measure the release of mercury from the specimen of amalgam restoration.

Results: Highly significant increase in the release of release of mercury from the specimen of amalgam restoration in relation to the times intervals.

Conclusions: In this study showed that release of release of mercury from the specimen of amalgam restoration, after treated with both 35% carbamide peroxide and 35% hydrogen peroxide increase with increase the time and compared with control groups.

Key word: Specimen amalgam restoration, mercury release, bleaching agents. (J Bagh Coll Dentistry 2012;24(1):82-84).

INTRODUCTION

In recent years, with more and more people interested in cosmetic enhancement, the demand of tooth bleaching is increasing sharply. Not only conventional bleaching of non-vital teeth, the needs for bleaching of vital teeth is also increase [1] Tooth bleaching can be performed externally, termed vital tooth bleaching [2] various methods and bleaching chemicals have been used extracoronally on teeth with vital pulps[3]. Bleaching systems that act by means of strong oxidizers are mostly used for brightening of teeth. Depending on the form of application, the concentrations lie between 10-35% peroxide. In particular, 35% concentrated hydrogen peroxide or carbamide peroxide are used. The action mechanism is based on oxidative discoloration of incorporated colorants. The most popular technique for the in-office bleaching of vital teeth involves 35% hydrogen peroxide, etching the teeth with phosphoric acid to facilitate bleaching and either a heating element or a light source to enhance the action of the peroxide[4]**.** The use of optical radiation in the so called light assisted tooth bleaching procedure has been suggested to enhance the effect of the bleaching agent [5]

Using a laser with a whitening gel, this is an in-office bleaching system. The translucent bleaching gel is applied to the teeth and a laser light is used to activate the crystals to absorb the energy from the light and penetrate the teeth enamel to increase the lightening effect on the teeth [6] . Dental amalgam fillings interact in a complex way with the environment in the oral cavity as they are subjected to chemical, biological, mechanical, and thermal forces. These forces change the restoration's appearance and properties, while metal ions, amalgam debris, non-metallic corrosion products, and mercury vapor are released into the oral cavity. The phenomena and conditions that affect the amalgam/environment interaction include the chemistry and biochemistry of the environment, formation of biofilms on the amalgam surfaces, existence of localized corrosion cells, galvanic contacts with other metallic restorations, abrasion during mastication and synergistic effects of the different forces[7] **.**

Recent concern however, has focused on the dissolution of mercury from amalgam in the oral cavity and the potential harmful effects of this phenomenon**.** Mercury dissolution from amalgam has been shown to occur in deionized water, saline, saliva, artificial saliva and other solutions**.** Measuring the effect of bleaching agents on mercury release from dental amalgam is important from both restorative and toxicological points view[8] **.**

MATERIALS AND METHODS

Fifthy four specimen of amalgam was prepared by using a ready made translucent plastic molds (used for medical tablets 3mm depth, 8mm width) had been filled with amalgam alloy. Dentsply

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amalgam alloy (Italy) used in this study is a high copper amalgam alloy. The dents ply alloy is mixed with mercury on a mercury/ alloy ratio of 1:1 (according to the manufactures instructions). After triturating for 9 seconds (according to manufactures instruction), small increment were carried with amalgam carrier, condensed by amalgam condenser and excess amalgam was removed with a sharp carver level with plastic surface. The bleaching process was done according to manufacturers instruction and this done by using a disposable brush to paint the totally cover the surface of the tooth and the time of application is 8 min and each sample three times application of pola office gel, each samples exposure to 40 second a curing light machine and Laser unit used for this study is continuous power (CW) Nd-YAG laser for exposure to the bleaching agent This step was repeated for four times for each sample as recommended by the manufacturers instructions Then the samples were washed using a continuous jet of syringe for one minute to dissolve the bleaching agent on the tooth surface and dried with air syringe for 30 seconds**.** Then storages in 10ml of de-ionized water in sterilized glass container and returned to incubator in 37Ċ until the time of testing.

Essential mercury release from sample in de-ionized water was analyzed In the department of chemistry in the Atomic Energy Commission by using Flameless atomic absorption spectrophotometer with Gold Vapor Generator following standardized procedure.

RESULTS

For statistical analysis was used in this study: means and standard deviation values of mercury release from the amalgam restoration that activated by two different light source are listed in table **(1).**The data revealed that there was increase in the mercury release values for the amalgam restoration over the time for all the groups and after bleaching with both 35% carbamide peroxide and 35% hydrogen peroxide. Statistical analysis of data by using ANOVA test show in table **(2)** revealed that there was a significant difference ($P<0.05$) among the control groups, while highly significant difference ($P<0.0001$) among when use light source (halogen light) and also highly significant difference ($P<0.0001$) among the different groups when use light source (laser light) at different period of times.

DISCUSSION

Results of present study showed that the specimen of dental amalgam had significantly higher mercury release value (all surface of dental amalgam) than the class l amalgam restoration (one surface of dental amalgam) when activated in both laser radiation and halogen light, after bleaching treatments. These results can be attributed to the mercury release from dental amalgam exposed to bleaching agent may be related to the available surface area of the restoration for chemical reaction with bleaching agent.

These result agree with the findings of **(9)**who found that the higher oxidation power increases the electromotive potential of the metal, as well as the rate of conversion of elemental mercury to mercury ions and also the amalgam restoration, demonstrated that oxidizing disinfectants (including: bleaching) mobilizing soluble mercury from amalgam into solution **.** It is clear from the results of this study table (3-1) that the mean concentrations of release mercury in tested solution of bleaching group (35% H.P with laser and halogen light) at the third period (96hours) were marked higher than the two other period of times. This adverse effect of bleaching agents on the specimen of amalgam in the increase of the mercury release over times was noted by many researches, showed that all the group exposed to bleach increase mercury over time**(10)**

The treatment with bleaching agent (35% H.P) compared to control group showed in the figure (1), explain the increase in concentration of mercury release in the testing solutions was two to three time than the control groups, This increase might be due to changes in the surface level of amalgam metallic components exposing the silver –mercury matrix, a potential source for Hg release. These result agree with**(11),** showed that changes appear to be caused by enhanced oxidation, corrosion and dissolution of the amalgam surface by hydrogen peroxide and its break down components. This result agree with**(12),** reported the chemical reactions that take place at the amalgam surface when exposed to bleaching agents causes that mercury ions are released from dental amalgam.

REFERENCES

1. Rodrigo A, Jose R, Hugo H, Luiz T, Rodrigo C. Effect of hydrogen peroxide topical application on the enamel and composite resin surfaces and interface Indian J Dent Res 2009; 20(1): 65-70.
2. Watt A, Addy M. Tooth discoloration and staining a review of literature. Br Dent J 2001; 190(6): 309-16.
3. Goldstein R, Garber D. Complete dental bleaching .1ste Chicago Quintessence Publishing Co Iinc.1995.ch. 1,2..
4. Goldstein R, Haywood B. Bleaching teeth: new materials-new role. J Am Dent Assoc. Quintes Int 1992; 23: 471-88.
5. Bruzell E, Johnsen B, Alerud T, Dahl J, Christensen T. In vitro efficacy and risk for adverse effect of light assisted

tooth bleaching photochemical Photo biological Sci. Dental Material. 2009; 8(13): 377-85.
6. Sun G. The role of lasers in cosmetic dentistry. Dent Clin North Am 2000; 44: 831-50.
7. Marek M. The effect of the electrode potential one the release of mercury from dental amalgam. J Dent Res 1992; 72: 13-5.
8. Robertello M, certosimo F, Dishman R, Rogack I, Wexel M. The effect of bleaching agents on mercury release from spherical dental amalgam. 2004; 11: 12-5.
9. Marek M. Interactions between dental amalgams and the oral environment. Adv Dent Res 2005; 6: 100-9.
10. Certosimo A, Roberto F, Dishman M. The effect of bleaching agent on mercury release from spherical dental amalgam. DART 2003.
11. Sturtevant C, Roberson T, Haymann H, Sturdevant R. The art and science of operative dentistry. 3rd edition. St. Louis: Mosby year book inc. ch2, 6,8,16. 1995. 206-88.
12. Al-Salehia S, Hattona P, Millera C, Mcleodb C, Joiners A. The effect of carbamide peroxide treatment on metal ions release from dental amalgam. J Dent Mat. 2005; 22(10): 948-58.

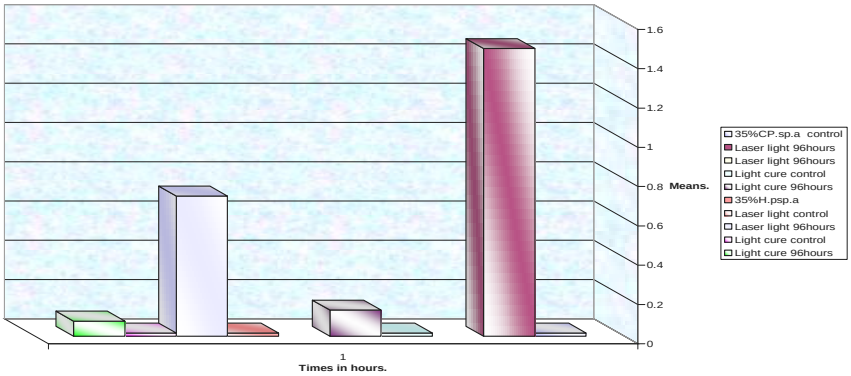

Figure 1: Bar chart shows the differences in means of the release of mercury values from specimens amalgam after treated with hydrogen and carbamide peroxide (96 hours) and compared with the control groups

Table 1: Descriptive statistics of mercury release from specimen amalgam of all groups in ppm.

Groups		Times	Mean	SD
Control		48h.control	0.0147	0.0006
		72h.control	0.0161	0.0004
		96h.control	0.0167	0.0004
Laser radiation	35%CP	48hours	0.8229	0.0434
		72hours	1.1229	0.0035
		96hours	1.4647	0.0097
Light cure	35%CP	48hours	0.0558	0.0055
		72hours	0.0770	0.0050
		96hours	0.1333	0.0104
Laser radiation	35% H.P	48hours	0.5260	0.0176
		72hours	0.6540	0.0097
		96hours	0.7140	0.0087
Light cure	35% H.P	48hours	0.0505	0.0002
		72hours	0.0551	0.0049
		96hours	0.0773	0.0053

Table 2: ANOVA test for release of mercury from specimen amalgam at different period of time when activated with laser light and halogen light

Agents	df	F-test	P-values	Sig
control	2	16.613	.001	S*
35%H.P Act. With laser	2	228.943	.000	HS**
35%H.P Act. With light	2	45.974	.000	HS

HS = Highly significant different (P< 0.0001).
S = signifiant different (P<0.005).