

## **Effect of Carbonated Beverages On Dental Fillings From Release Of Ag & Hg Ions**

**تأثير المشروبات الغازية على حشوات الاسنان من خلال تشخيص ترحيل أيونات الفضة والزنبق**

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### **Summery**

The objective of the current study was to investigate the release of Ag and Hg ions from filing. Four commercial fillings were used in the experiments, all fillings samples, disc with diameters of 10 mm and thickness 3mm were used, made by the manufacturer. Four samples of carbonated beverages (Pepsi, Seven – up, Merinda, and Sinalco) were used for each tested filling and tasted with times.

The ion release from above tasted filling in the above mentioned carbonated beverages was measured over 4 time intervals, i.e. after 0, 1 , 24 hours and 7 days respectively. Carbonated beverages were analyzed by atomic absorption spectrophotometer. Results show that Ag and Hg filling released great amounts of Ag and Hg ions in all four carbonated beverages so that on the very first time of measurement these amounts exceeded the approved daily dietary intake of this elements. Gradually, the amount of the released Ag and Hg ions increased with great variability in all carbonated beverages.

### **الخلاصة**

هدف الدراسة الحالية الى تشخيص ترحيل ايونات الفضة (Ag) والزنبق (Hg) من حشوات الاسنان. تم استعمال اربعة حشوات اسنان تجارية في التجارب وجميع الحشوات ذات ابعاد القطر 10 ملم والسمك 3 ملم، تم استعمال اربعة نماذج من المشروبات الغازية (بيبيسي وسفن أب وميرندا وسينالكو) في اختبارات حشوات الاسنان مع الوقت. ان ترحيل الايون من الحشوة السنية في اعلاه في المشروبات الغازية قيست باربعة ازمان هي: الصفر، 1، 24، ساعة و7 ايام على التوالي. المشروبات الغازية تم تحليلها بواسطة جهاز المطياف الذري، وقد اظهرت النتائج ان حشوات الاسنان للفضة- زئبق رحلت كميات كبيرة من ايونات الفضة (Ag) والزنبق (Hg) في جميع المشروبات الغازية وقد كان الترحيل على اعظمه في الاوقات الاولى. وان الترحيل لايونات الفضة والزنبق ازداد بالتدرج في جميع المشروبات الغازية.

### **Introduction:**

Dental erosion has been reported to be a growing health problem (1, 2) possibly accounted for by the monumental increase in the consumption of soft drinks, fruit juices and sport drinks in the UK, US and many other countries(3). Erosion is the chemical dissolution of the surface of dental hard tissues by acids without the involvement of microorganisms (4). Its process can lead to reduction in size of teeth and depending upon the severity and length of exposure, may lead to the total destruction of the dentition (5). Most people view soft drink consumption as fairly innocuous and its consumption is not as harmless as generally believed; however, there are a number of serious health issues associated with regular consumption of soft drinks. One previewed study has reported 25 separate harmful effects associated with the consumption of carbonated soft drinks (6). This review presents current perspectives about the determinants of soft drinks incited dental erosion.

Dental Amalgam fillings, sometimes called “Silver amalgams”, are actually half mercury. They are a time – release poison, a major source of mercury to those who have them (7). Amalgam is an alloy of mercury with another metal that is solid or liquid at room temperature according to the proportion of mercury present and is used especially in making tooth cements (8). The American Dental Association (ADA) Defines dental amalgam as an alloy composed of mercury, silver, tin and copper along with other metallic elements added to improve physical and mechanical properties (9).

A “silver filling” is a euphemism for an amalgam restoration, which a dentist places in a patient’s tooth after a cavity is created by drilling out decay. Amalgam restoration consist of mercury, silver, tin, copper, and a trace amount of zinc. The dental amalgam metals are cations. The net result of the tendency for covalent, ionic and metallic bonding and Vander Waals force between amalgam Cations is a weak repulsion. So there is a sustained release of mercury and other metals from the amalgam into the body. Researchers have measured a daily release of mercury on the order of 10 micrograms from the amalgam into the body. Mercury is a toxic metal, the most minute amount damages cells (10).

Corrosion of alloys occurs in oral environment. The biocompatibility of dental alloys is a critical issue because these alloys are in longterm intimate contact with oral tissues. The biocompatibility may correlate with elements of dental alloys. The release of elements from dental alloys is directly related to adverse biological effects. Certain environmental conditions around the alloy will affect the release of elements. A reduction in pH will increase elemental release from dental alloys. Studies have shown that the release of elements from the alloys may correlate with different factors (11,12).

Wataha and other many investigators have been studied about the affects of the ions released. They have shown that the relationships between elemental release and toxicity are complex. Several statements can be said about release of elements from dental alloys. In the mouth, alloys may be exposed to transient pH changes either from foods or plaque. The reduced pH would increase elemental release because it acts like corrosive medium.(13,14,15,16)

The aim of this investigate since Ag and Hg are a group of elements which improve the soldering ability of fillings they are commonly added to them, at least in minimal amounts. However every often the manufacturer does not state its presence. In addition, Ag and Hg are considered to be the greatest allergen. Moreover, Ag and Hg are cytotoxic and cancerogenic. The

objective of this study was to investigate how different factors such as the carbonated beverages in which the filling is submerged and exposure time affect the amount of released Ag and Hg ions from above mentioned fillings.

## **Material and Methods :**

### **Sample Preparation:**

Four specimens made from dental alloy Tytin (amalgam) mixing proportion 57.5% weight of alloy [Ag,Sn,Cu] and 42.5% weight of [Hg] were provided in the form of 10mm diameter discs, 3mm in thickness. Four samples of carbonated beverages (Pepsi, Seven – up, Merinda, and Sinalco) used for each filling. Ion release from the fillings was measured over the following time intervals: on the 0, 1, 24 hours and 7 days placed and incubated at room temperature.

### **Atomic absorption spectrophotometer analysis:**

Atomic absorption spectrophotometer (AAS) (Shimadzu – 660 , Japan) was used to determine the release of elements from the fillings into carbonated beverages.

Silver (Ag) and Mercury (Hg) were selected for analysis based on previous research which showed that they were released from filling.

Statistical analysis were assessed with two – way ANOVA. At the same time, Kolmogorow – Simirnow and repeated measures of ANOVA were used least significant difference – LSD test was used to compare between means (17).

**Results :**

The release amount of elements in carbonated beverages were determined to ng/ ml = Microgram/L = ppm. These data were obtained like this: (The experimental result – the control result). The results are illustrated in tables 1 and 2.

residual Hg Type	Control	1 hr	24 hr	7 days
Pepsi	6.471	11.940	7.841	4.105
Seven up	0.781	3.571	1.052	5.940
Merinda	1.631	8.000	5.891	9.210
Sinalco	8.157	8.471	8.151	4.210

Table 1: Effect of type & time in residual of Ag.

residual Ag Type	Control	1 hr	24 hr	7 days
Pepsi	0.022	0.023	0.005	0.005
Seven up	0.014	0.005	0.008	0.007
Merinda	0.006	0.021	0.022	0.017
Sinalco	0.026	0.019	0.023	0.023

Table 2: Effect of type & time in residual of Hg

The release of Ag and Hg ions were statistically significant according to carbonated beverages, these results are illustrated in tables 3 and 4.

Table 3: Ag ions released according to types and time intervals .

Type	Time				LSD Value
	Control	1 hr	24 hr	7 days	
Pepsi	6.471 ± 0.56	11.940 ± 0.93	7.841 ± 0.52	4.105 ± 0.42	3.092 *
Seven up	0.781 ± 0.67	3.571 ± 0.07	1.052 ± 0.006	5.940 ± 0.39	1.879 *
Merinda	1.631 ± 0.69	8.000 ± 0.67	5.891 ± 0.31	9.210 ± 0.86	3.175 *
Sinalco	8.157 ± 0.84	8.471 ± 0.790	8.151 ± 0.63	4.210 ± 0.37	2.361 *
LSD Value	3.416 *	2.792 *	2.873 *	2.664 *	---

Table 4: Hg ions released according to types and time intervals .

Type	Time				LSD Value
	Control	1 hr	24 hr	7 days	
Pepsi	0.022 ± 0.003	0.023 ± 0.001	0.005 ± 0.00	0.005 ± 0.00	0.0026 *
Seven up	0.014 ± 0.002	0.005 ± 0.00	0.008 ± 0.001	0.007 ± 0.001	NS
Merinda	0.006 ± 0.00	0.021 ± 0.001	0.022 ± 0.001	0.017 ± 0.00	0.0024 *
Sinalco	0.026 ± 0.001	0.019 ± 0.001	0.023 ± 0.001	0.023 ± 0.002	NS
LSD Value	0.0022 *	0.0020 *	0.0016 *	0.0025 *	---

\* (P<0.05) , NS: non-significant.

### **Discussion :**

Fillings are subjected to a variety of chemical environment in the mouth. The dynamic natures of intraoral conditions cause corrosion. The release of an element from filling depends on some factors such as the nature of element, filling composition, and multiple phases of filling. Therefore some of metal elements have an inherently higher tendency to be released from fillings. The biological liabilities may be related to the release elements. The release of elements from fillings has been investigated with many different material and methods by different researchers (18,19).

In one study that compared acid clearance of noncarbonated and carbonated soft drinks in the mouth, there was no statistical difference in the clearance between the drinks. It was concluded that carbonation may not directly responsible for the erosive potential of different beverages (20). Other vitro studies have shown that cola drinks, despite having the lowest PH on opening, were easier to neutralize than the fruit juices and non – cola drinks (21,22) , while jain *etal* (23) concluded from their study that non – cola drinks were more erosive than cola drinks. The type of acid has been used to explain the ability of the non – cola drink and fruit juices to resist PH change, phosphoric acid is normally used in the cola drinks while citric acid predominated in the fruit juices and the non – cola drinks. Surprisingly an in vitro study ahs shown that the citric acid caused far more erosion than phosphoric acid (24).

Our results revealed that Ag was more active than Hg. As expected, reduced PH dramatically increased Ag release from the Ag – based filling in the present study. This result is essentially identical to trends seen in previous studies performed in a 72 hours period (18).

Previous studies support the idea that composition of filling surface is critical to elemental release behavior for base – metal fillings (19).

High consumption of carbonated beverages lead to release more Ag and Hg ions as showed clearly in the data and increased risk of dental caries.

### **Conclusions :**

Great amount of Ag and Hg ions were released from the Ag – Hg filling in all four carbonated beverages as early as the first day of the measurement. This exceeded the approved daily dietary intake of silver. The amount of the released Ag ions increased gradually with great variability in all carbonated beverages. Therefore Ag – Hg filling should be used exclusively for fillings.

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