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Research Article

Toxic Heavy Metals in Human Blood in Relation to Amalgam in Baghdad City

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Abstract

Mercury (Hg), Zinc (Zn), Silver (Ag), Tin (Sn), and Copper (Cu) are systemic toxic heavy metals which are hazardous to people health. However, as these components accumulate in the human body as a result of conventional and classical usage of dental amalgam and aggregation of the same elsewhere in the world, they are becoming more prevalent. This study done to measurement of some heavy metals (mercury, silver, zinc, copper and tin) in human blood from persons lived in Baghdad City have amalgam in their teeth, and to gain some information about accumulation, toxicity and concentration these heavy metals in human blood. The blood was analyzed in relation to the user's age, ethnicity, and use history. The atomic absorption spectrophotometer (AAS) was used to measure metals in blood samples, with the exception of mercury (Hg), which was measured using frozen gases after the sample was digested with nitric acid. The levels of mercury (Hg), sliver (Ag), copper (Cu), Zinc (Zn) and Tin (Sn) recorded high levels with significant differences in persons have amalgam compared to control group.

Keywords: Heavy metals; Mercury; Silver; Tin; Copper; Amalgam

Introduction

Since heavy metal pollutants can be easily detected in the air, water, and food, almost everyone is at risk in different ways [1]. As "heavy metals" are absorbed into the chain of the human food, the acid medium in the intestine transforms them to stable oxidation states, and then interact with enzymes and protiens to build up in the human body [2]. Since these metals have accumulated impacts on the human body and accrue in the body for long periods of time, even at small levels, these metals' ingestion is still extremely toxic [3]. Due to their tendency to produce highly reactive free radicals, such heavy metals are well known as systemic toxicants, thereby proteins' sulfhydryl groups are oxidized by them [4]. Amalgam fillings are mostly made up of 50 percent pure elemental mercury, 35 percent silver, 13% tin, 2% copper, and a bit of zinc [5,6]. The liquid mercury interact with metal powders to form an amalgam (or alloy), which is a lightweight composite that can be compressed and moulded easily [7]. Because of their shape and structure, amalgam fillings are often referred to as silver fillings [8-10]. Because of its versatility, amalgam is thought to need less abilities. As a result, dentists will normally fill a hole in a shorter amount of time.

The American Dental Association (ADA) recommend the use of amalgam for a variety of reasons, including its ease of use, relatively inexpensive, and excellent long-term efficiency [11]. Strong metal concentrations in human blood are determined by two intrinsic factors: age and gender. As a result of Hg amalgam fillings in the teeth, metal accumulation related to age and gender becomes important in the overall measurement of heavy metal toxicity in humans. Gingivitis, loosening and loss of teeth, alveolar bone weakening,, bruxism, metallic taste, prolonged salivation, and oral ulceration are all well-documented and reported as symptoms of chronic mercury toxicity [12]. "Tremor, ataxia, mood changes, memory loss, insomnia, anxiety, nausea, depression, headaches, irritability, slowed nerve conduction, weight loss, appetite loss, stomach complications, and psychiatric discomfort" are some of the symptoms associated with mercury poisoning [13,14]. Mercury vapour can be inhaled and enter the bloodstream. Contrariwise, the cells including with their genetic material are damaged. Tin, silver and Copper (and zinc, more rarely) also may possibly be deposited in the body, and they can be toxic too when present in high amounts. Other metals (zinc, silver, tint, copper and others) are not emitted in significant quantities into the body or the atmosphere Copper is a metal that is used to make electrical wires. Metal fume illness, a flu-like reaction, and blood disturbances are possible side effects. Silver overexposure may result in graying of the skin, hair, and vital organs. Nausea, fatigue, and diarrheal are possible side effects. Long term exposure to zinc can result in flu-like complaints, stomach and intestinal abnormalities, and/or liver disorder. Tin poisoning can harm the nervous system and result in psychomotor symptoms such as convulsions, tremors, psychotic behaviour and hallucinations. Taking all available data into account, amalgam can neither in medicinally, nor in the field of occupational medicine, nor ecologically be considered a safe tooth filling material [15].

Materials and Methods

Study design

The study's main drawback was the challenge of obtaining a sufficient population sample. Individuals who participated but were chosen at random from representative districts around the state make up the survey population. It was made up of 50 people that wanted

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to volunteer for the report, from Baghdad City laboratories, from male. Among them, 25 were people whose teeth don't have exposed to dental amalgams, and 25 of them had mercury amalgam fillings in their teeth, making them eligible for blood testing for mercury, tin, silver, and copper zinc concentrations. Participants had to be at least 18 years old, not exposed occupationally to the three metals studied, and weigh between 64 and 105 kilograms. They also had to have had amalgam-filled and non-amalgam-filled periods of exposure for longer than two years. The blood tests were then taken via venipuncture (5 mL), put in a non-heparinized tube, and centrifuged for 15 minutes at 3000 rpm. All of the samples of blood serum were analysed by. Expect mercury (Hg) to be analyzed by frozen gases during sample digestion with nitric acid using an Atomic Absorption Spectrophotometer (AAS) [16].

Statistical analysis

Statistical analysis has been implemented with the Statistical Set for Social Sciences (SPSS) 21.0 and Microsoft Excel 2013. And draw the figures with some effects. To determine the significant different (between means of control and treatment for each parameter, Using t-test at ($p \leq 0.05$) and expressed as (Mean ± SEM).,The statistical significant difference's lowest level is bellow or equal to 0.05.

Result and Discussion

Since the dawn of time, there has been a heated discussion over the purity and effectiveness of amalgam fillings. It has recently risen to such a feverish level that it appears to have drowned out all other voices of reason. Amalgam has been a part of the dentistry business for almost 165 years [17]. It was found that Ag g/dl level increases with increase of age, weight and periods of use, it was significant (13.1 g/dl) and non-significant (7.1 g/dl) at 0.05 levels. As showed as in Table 1 Amalgam has the potential to cause delayed allergic reactions in certain people. The signs of these responses are normally dermatological or oral in nature. Some people may become sensitized to mercury from amalgam restorations, rendering them more vulnerable to oral lichenoid lesions. The infected people are barely aware of the oral lesions, and they cause little pain. It has been confirmed that A certain amount of lichenoid lesions are affected by amalgam restorations [18]. The presence of biofilm on such repairs, rather than the material itself, can lead to the production of hypersensitive reactions. Allergies to amalgam include skin rashes in the mouth, scalp, and neck, itching, swollen lips, and localized eczema-like lesions in the oral cavity. These symptoms normally do not need surgery and may go away on their own within a few days of exposure. In certain cases, though, an amalgam reconstruction must be discarded and replaced with a different restorative content. Significant changes have resulted from the replacements [19]. The outcomes revealed that there was a considerable difference (5.8 Mg/g) ($p \leq 0.05$) in Hg levels and non-significant (2.9 Mg/g) with increase of age, weight and periods of use, as showed as in Table 1. Toxicity of Mercury is linked to its tendency to sulfhydryl groups (–SH), which causes balanced complexes and a variety of changes, including structural alterations in sulfhydryl enzymes and inactivation of their active sites [20]. The decrease in antioxidant defenses suggests that mercury consumption will raise Reactive Species (RS) levels, causing an instability in the pro-oxidant/antioxidant system and oxidative stress [21,22]. It may be noted that Cu Mg/g in human blood was significantly (3.0 Mg/g) And non-significant (0.61 Mg/g) greater in accordance with incidence increase in of sample that exposed to dental amalgam, with increase of age, weight and periods of use, as showed as in Table 1, these may be symptoms associated with copper deficiency in humans include normocytic, hypochromic anemia, leukopenia. Most species use a mixture of regulated import, sequestration, and better export systems to defend themselves from metal-induced toxicity. Metal conditions are controlled by metal-binding proteins at the transcriptional, enzymatic, and translational levels; the involvement of a complex mechanism of metal ion carriers and chaperones to control Cu equilibrium ensures that Cu is delivered to important proteins without causing cellular harm. Cu homeostasis disturbances are linked to tissue injury and a variety of illnesses [23,24]. Several pathways, including free radical-induced oxidative disruption, have been suggested to understand Cu-induced cellular toxicity, in addition to direct interactions with important macromolecules and minerals. The amount of Zn Mcg/ml in blood show significant (2.8 Mcg/ml) and no- significant (0.75 Mcg/ml) associations with increase of age, weight and periods of use. Similarly, with regard to weight as showed as in Table 1. Metal Fume Fever (MFF), that is induced mostly by breathing zinc oxide, is the well-known result of inhaling zinc-containing smoke. Exposure to high concentrations of fresh metal particles with a particle size of 1 m in workplace conditions such as zinc smelting or welding causes this acute condition, which is an industrial disorder [25]. "Fever, muscle soreness, weakness, exhaustion, and respiratory effects such as chest pain, cough, and dyspnea" are some of the most prevalent symptoms related to this reversible illness, which arise a few hours following an acute exposure [26]. A rise in bronchiolar leukocytes has been observed in conjunction with respiratory illnesses MFF is not fatal in most cases, and the respiratory symptoms subside within one to four days [27]. MFF development is linked to the extent of contamination, however, a very little information about the zinc amounts is available that cause this syndrome [28]. Zinc is considered typically harmless when comparing it to several other metal ions that have similar chemical features. Acute zinc intoxication occurs only in elevated concentrations, making it an uncommon occurrence. Aside from extreme intoxication [29]. Zinc is thought to be reasonably safe, particularly when taken by mouth. Large intake, on the other hand, can induce system malfunctions, impairment in reproduction and growth [30]. Diarrhea, liver failure, bloody urine, vomiting, (yellow mucus membrane), anemia, and renal failure have all been identified as clinical symptoms of zinc toxicity [30,31]. The result was found the difference in blood tin Sn Mg/g levels between the amalgam-filled and non-amalgam individuals was considerable (1.59 Mg/g) and non-significant (0.77 Mg/g), with increase of age, weight and periods of use, As showed as in Table 1. Even if only a few toxicological trials have been performed, it is widely agreed that inorganic tin exposure is very mild. Except for tin hydrides and inorganic tin complexes, a preventive limit value (time weighted average) for tin in air was set at 0.1 mg as a maximum occupational dose in 1979, however it was later increased to up to 2 mg [32]. However, due to its higher toxicity, the initial limit value for organic tin compounds remained

Table 1: Comparison of heavy metals in human blood that exposed to dental amalgam and not treated with amalgam.

Heavy metals	Control (n =25)		Treatment (n =25)		P-Value
	Mean	SD	Mean	SD	
Ag g/dl	7.1	0.6	13.1	2.1	0.05*
Hg Mg/g	2.9	0.5	5.8	1.1	0.05*
Cu Mg/g	0.61	0.14	3	1.2	0.05*
Zn Mcg/ml	0.75	0.11	2.8	1	0.05*
Sn Mg/g	0.77	0.1	1.59	0.53	0.05*

*P ≤ 0.05 consider significant.

just confirm. The majority of the previously documented local and systemic hazardous effects in humans have been confirmed, such as neurotoxicity produced by tin hydride inhalation but no hemolysis induced by tetra-hydrogenated tin (SnH4). "Skin rashes, stomach complaints, nausea, vomiting, diarrhea, abdominal discomfort, fever, and palpitations can occur at high levels of inorganic tin compounds, while low levels can induce exhaustion, weakness, low cardiac left activity, low adrenals, shortness of breath, asthma, headaches, and insomnia" [33].

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