

<p>A Panoramic View About Side Effects of Amalgam Fillings and their Safely Removal</p>		<p>Healthcare</p> <p>Keywords: Amalgam, safety removal of amalgam, oral mucosa.</p>
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<p>Edlira Dedaj</p>	<p>Kristal University, private clinic.</p>
<p>Rozarka Budina</p>	<p>University of Medicine, Tirana, Faculty of Dental Medicine.</p>
<p>Henri Dedaj</p>	<p>Private clinic.</p>

<p>Abstract</p> <p>Amalgam is the oldest material used as a definitive restoration of teeth. Many countries have banned it’s use, others have reduced it. More and more Amalgam is being accused for many damages it causes in the human body, as a result of mercury release in the oral cavity. Mercury is a heavy metal, with accumulative properties, especially in neural tissue. Damages caused by mercury are studied by many authors. An important problem remains the safety removal of amalgam from patients teeth, where is presented or not any pathology from it. Today in Albania, it’s removal is still done with no precaution.</p> <p>Aim: To give our own experience in safely removal of amalgam fillings.</p> <p>Material and methods: There are taken 24 subjects under the study with teeth filled with amalgam, who wanted to change those fillings. From those, 3 had lichenoid reactions in the oral mucosa near the amalgam filling, 8 subjects had damaged filling or secondary caries and 13 subjects wanted to replace their amalgam fillings for esthetic reasons. The period of the study was 3 years.</p> <p>Results and discussion: The replacement of the amalgam fillings was done in all the subjects. They had only one filling to change, except one subject with lichenoid reaction near amalgam fillings. He changed 3 amalgam fillings, for a period of four months. In 100% of cases, were presented no complaints. In the subject, where were changed 3 fillings, the lichenoid reaction disappeared after 12 weeks.</p> <p>Conclusions: The removal of amalgam from teeth fillings, should be done following a standardized protocol, which preserves both the safety of the patient and the doctor, from the high exposure to mercury vapors.</p>

Introduction

Amalgam is a material used for dental restorations for more than 170 years. The name is referred to a chemical-physical process, through which is done a mixing of metals in different physical states and the product then passes to a crystalline phase. Usually in our daily work, we hear about Silver alloy amalgam, thinking it is referred to the metal in the major amount in the powder, but in fact, the metal in the major amount in full mixture is Hg.

For the first time Amalgam alloy was used from peoples in Latin America. In 1816, it was used from August Traveau, while England it was used first from Bell. Black, in 1896 used the first recipe for dental amalgam alloy. There are included these elements:

Hg (mercury) – 52% of all the mixture. The rest was compound from:

Ag (silver) – 68.5%

Sn (tin) – 25.5%

Cu (copper) – 5%

Zn (zinc) – 1%

Essentially, the amalgam alloy preparation predicts a mixture of a liquid substance with a solid one, the latter is compound from little particles of many elements. The percentage of these elements changes according to the type of the alloy used. And according to these percentages, are done many classifications : the classic amalgam alloy, amalgam without gamma-2 phase, amalgam with high copper, etc. the higher percentage of copper, provides to the alloy a higher mechanical properties and resistance to corrosion.



Fig1. Amalgam filling in the upper jaw-A.L. 36 years old (clinic of Dr.Edlira Dedaj)



Fig2. Amalgam filling in the lower jaw-A.L36 years old (clinic of Dr.Edlira Dedaj)

During the mixture of the two compounds (liquid and solid) happens amalgamation or trituration, which comprises the “fusion” of the solid particles in mercury. In the end of this process is obtained a plastic compound, which crystallizes forming amalgam.

The microstructure of this material is very complex and depends from the features of the particles that constitute the solid part. The study of amalgamation and the result compound is done for many years. These studies have revealed the existence of many complex phases, which are different from those in metallic bonds, as a result of their dynamic development, undergoing important processes of internal reorganization (1).

For a long period of time, was thought that amalgam, after setting was a material very solid and inert, where all the mercury, was included inside of chemical bonds with other metals and had no possibility to be released in the oral cavity. This would be an ideal for every dental restoration material. But the studies have revealed the opposite. For more than 20 years, is confirmed that from amalgam alloy is released continually mercury, in the saliva of patients with amalgam fillings in their mouth.

All the metals in the amalgam alloy are potentially toxic. Studies have revealed that amalgam fillings release continually mercury. This element is very toxic, especially for the neural tissue (where it is accumulated) and

kidneys. The substitution of this material from different generations of dental composites, was not done only for esthetic reasons. The main reason was the fact, that patients were exposed continually to mercury released in their oral cavity. The phenomenon of the mercury release does not simply depend only from the corrosion of the material, but from a chimico-physic phenomenon. When the material is formed, is mixed Hg with the Sn-Cu bond, and mercury is a little more in amount than the powder. The reason is to realize the wetting of all solid particles. In a few minutes begin to form the crystals of the new bond with Hg inside. The newly formed crystals present a molecular structure not fully perfect and adsorb too much Hg. The crystalline structure during years presents an evolution and maturation phenomenon. This makes to be need fewer Hg than is bond in the beginning. A part of mercury came out of the crystalline bond and is added to the non bonded mercury, present in the origin of the material. It is exactly this amount that can move freely in the metal that comes out in the surface of amalgam like the water that forms an Oasis. So are present microdrops of mercury, which in 37 degrees Celsius evaporate like mercury vapors in the oral cavity. Their existence and their percentage are evaluated easily with analytic methods, in individual's mouths with amalgam fillings. Studies have begun till 1980, measuring the exhaled air and then that released in the oral cavity.

The first official paper from OMS, about inorganic mercury, in 1991, was helped very much by the work of Svare, who shows how vapors of Hg are always present in the oral cavity of the subjects with amalgam dental fillings even in cases where there was not a stimulation of obturated surfaces. The study of this author has shown how these concentrations are raised after mastication. In the OMS report, are mentioned even the works done from Vimy and Lorscheide (11), who talk about the behavior of amalgam fillings in rest and stimulation from mastication and then in rest again (12). Taking into account that this phenomenon happens three times a day (excluding other cases of stimulation as hot food and drinks, washing teeth) it's understood that evaporation of mercury is not a coincidence.

Studies have shown that the amount of mercury released every day in the oral cavity is 0.5-1 µg. This amount released is presented in three forms:

- Elementary mercury (Hg^0) that is released continually from amalgam fillings
- Ionic mercury (Hg^{2+}) that derives from oxidized vapors of mercury
- Organic mercury that derives from bacterial biotransformation of organic mercury

Ions of Hg that are released in saliva during mastication increase if there are physical-chemical changes (changes of pH, changes of temperature, presence of acidic foods, presence of disease like diabetes, liver diseases). It's confirmed that these ions released in saliva stimulate an allergic reaction that in classifications of Gel and Coombs is of the IV type (1,2). It is called also late sensitivity, exactly for the latency period that it is manifested. This reaction is manifested after 24-48 hours of first exposure and is due to cellular immunity and the production of cytokines that stimulate a complex answer. The allergic reaction of the IV type is manifested with the presence of macrophages and T lymphocytes, which are stimulated from toxic substances (bacteria, viruses, fungi, pharmacological substances, chemical compounds) that act like antigens causing the allergic reaction (6). It's results are the production of different types of cytokines (limphokines, proteins secreted by leucocytes during immunological response), which call, activate and hold monocytes in the affected zone (7). As a result there are released enzymes that cause tissue destruction resulting in inflammation. The clinical view in the mouth is presented by contact stomatitis or lichenoid lesions (8,9)

Incorporation of amalgam particles, during it's removal without using predefined protocols, or during teeth extractions, is a reason of appearance of another pathology like amalgam tattoos.

Removal of amalgam is the procedure that exposes mostly the patient to a higher amount of mercury vapor. This procedure is realized using drilling of amalgam fillings. From this drilling are released mercury vapors.

The average adsorption of mercury from amalgam fillings in the carrier population, estimated according OMS is 12-100 µg. If the amalgam fillings have to be removed, without following the standardized procedure leads this amount to 2000 µg/m³, and can lead to acute intoxication of the patient.

Aim

To give our own experience in safely removal of amalgam fillings.

Material and method

There were 24 subjects under the study with amalgam fillings in their mouth. From these, 3 subjects had lichenoid reactions in the oral mucosa near amalgam fillings, 8 subjects had damages of the obturation or secondary caries and 13 subjects wanted to change the amalgam filling for esthetical reasons. In all these subjects was used a well predefined protocol. Firstly, the subjects were undergone to a healthy alimentary therapy, increasing their oral taking of vitamin C (500mg/day)

During these procedure were used steel drills and in an inevitable way the rubber dam.

Diamante drills gives abrasive cutting, so increase the temperature, that's why they are not used

Drills preferably should be long flame

The rotary instruments that were used, were low speed

The temperature should be as cool as possible (increase amount of water and decrease the amount of air)

The periphery of the filling was cut and the rest was detached mechanically from the tooth using levers or excavator

The use of rubber dam is undisputed. Today there exist even dams unpermeable from mercury.

Aspiration is essential even for the patient and for the doctor also. The normal saliva ejector, is not enough, so it was necessary to use the surgical aspirator.

The doctor should use masks with carbon or Iodine. In our case was used mask with carbon filter.

It is not allowed the removal of many amalgam filling for a short period, because it increases the possibilities of exposure. In our study was removed an obturation for every subject. In a subject were replaced 3 amalgam fillings, and was respected the time of changing the fillings (the two first fillings were replaced with a difference of one month from each other and the third filling two months after the substitution of the second filling).

After the substitution of the fillings the subjects filled a questionnaire:

1. Have you ever had muscular tremors?
Yes
No
I don't know
2. Have you ever had tiredness, agitation and nervousness?
Yes
No

3. Do you feel sleeplessness?
Yes
No
4. Do you have difficulty in concentration, loss of memory?
Yes
No
I don't know
5. Have you ever had diarrhea, nausea?
Yes
No
6. Have you ever had loss of appetite?
Yes
No
I don't know

All the subjects during one month are undergone to intraoral examinations, to see the oral mucosa and presence or not of ulcerations in it.

Results

In 24 examined subjects, who were presented to change their amalgam fillings with composite fillings, was done the substitution procedure following the predefined protocol. None of the subjects show complaints like tiredness, headache, nausea, muscular pain etc. The subject with lichenoid reaction near amalgam fillings, that replace three fillings, resulted with the disappearing of the lesion for a period of 12 weeks. The 2 other subjects with the same pathology resulted in the way of healing, in the follow ups after 4, 8 weeks.



Lichenoid reaction in vestibular mucosa near amalgam fillings (subject DC, age 39 years)



Improved reaction likenoid 4 weeks after replacement of amalgam fillings (subject DC, age 39 years)



Likenoid reaction extinction 8, 12 weeks after replacing amalgam fillings (subject D.C, age 39 years)



Replacement of amalgam filling, because of damage to the filling (subject M.B, age 18 years, before and after the replacement of the filling)



Replacement of amalgam filling that requested by the patient (subject M.V, age 26 years, before and after replacement of the filling)

Discussion

Removal of amalgam is the procedure that exposes mostly the patient to a higher amount of mercury vapor. This procedure is realized using drilling of amalgam fillings. From this drilling are released mercury vapors.

The average adsorption of mercury from amalgam fillings in the carrier population, estimated according OMS is 12-100 μg . If the amalgam fillings have to be removed, without following the standardized procedure leads this amount to 2000 $\mu\text{g}/\text{m}^3$, and can lead to acute intoxication of the patient.

It is not allowed the removal of many amalgam fillings for a short period, because it increases the possibilities of exposure.

In the replacement of amalgam fillings should be followed a well predefined protocol.

Conclusions and recommendations

The removal of amalgam is a procedure that should be done following a standard protocol, which looks the safety of the patient and also the doctor, from the high exposure to mercury vapors.

Recommendations:

- Avoid removal of amalgam in subjects that present allergy to it, in pregnancy, lactation, children under 6 years old, patients with liver disease and neural system pathologies
- Amalgam fillings near other metallic restorations should be replaced, to avoid corrosion
- Assure to be prepared before replacing an amalgam filling to decrease the risk of passing Hg to the body (detoxication preparation: the use of rubber dam, powerful aspiration, mask with carbon filter, covering of exposed body surfaces with clothes, the use of the drill with cooling to eliminate the evaporation etc.)
- It is recommended that before the removal procedure of amalgam fillings, should be preceded with detoxication of the body from Hg, in other words to remove Hg from the tissues where it is accumulated and eliminate it. In case of a compromised immunity must be careful while replacing amalgam fillings, because could change the equilibers and cause serious problems.
- It is recommended that the replacement of amalgam fillings must be done after the body detoxication.

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