Toxicidade da restauração de amálgama: revisão da literatura

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ABSTRACT

A literature review was carried out concerning the possible risks of the use of amalgam in regard to the toxicity of mercury. Despite the fact that the American Dental Association (ADA) and the Food and Drug Administration (FDA) do support the use of amalgam, it is noticed that still today there are controversies regarding its use. In many countries such as in the United States, Sweden and Canada, there are groups which oppose the use of amalgam and they also defend a planned reduction in the odontological practice, mainly due to environmental reasons. We have observed that individuals with amalgam restorations indeed have a higher transitory level of mercury, both in blood and in urine This concentration is not harmful to their health, however. It should be made clear to patients that there are other sources of mercury absorption such as food, cosmetics among others and that we should take the necessary steps as to minimize the contamination of the practitioners, the patients as well as the environment. Even though they are aesthetically unsatisfactory, in the long run amalgam restorations have proven to have an excellent clinical quality.

UNITEMS

toxicity; mercury; dental amalgam.

RESUMO

Realizou-se uma revisão da literatura sobre os possíveis riscos na utilização do amálgama com relação à toxicidade do mercúrio. Verificou-se que ainda hoje existem controvérsias sobre sua utilização apesar da American Dental Association (ADA) e American Food & Drug Administration (FDA) apoiarem sua utilização. Em muitos países como os Estados Unidos, Suécia e Canada, existem grupos contra sua utilização, apoiando uma redução planejada de seu uso na prática odontológica, principalmente por razões ambientais. Observamos que indivíduos com restaurações de amálgama têm um nível transitório maior de mercúrio, no sangue e urina sendo que esta concentração não é prejudicial à saúde. Devemos esclarecer aos pacientes sobre outras fontes de absorção de mercúrio como alimentos, cosméticos e outros e que devemos tomar os cuidados necessários para minimizar a contaminação dos profissionais, pacientes e meio ambiente. As restaurações de amálgama, apesar de esteticamente insatisfatórias apresentam-se, a longo prazo, uma qualidade clínica excelente.

UNITERMOS

Toxicidade; mercúrio; amálgama dental

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INTRODUCTION

Dental amalgam has been in use for over a century and a half, its quality has been improving ever since. Amalgam restorations are durable, efficient and are relatively accessible but it does present some restrictions such as a lack of aesthetics and possible mercury toxicity.

Extensive media coverage on aesthetic restorations has allowed the general public to become acquainted with dental restorative materials and techniques that are more similar to natural teeth[26].

As for possible mercury toxicity, despite the fact that it has been considered safe and effective, amalgam does cause concern regarding the effects it may have on human health[2].

Concerns with ecology have led some countries to abandon the use of amalgam in dental restorations. However, the information disseminated by the media, almost always based on non-scientific facts, have aroused half truths on the effects of amalgam on human health[6].

We have conducted a review of the literature in order to verify the possible risks of the use of dental amalgam on human health.

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Review of the Literature

In 1990, Bergman[3] reported that dental restorative materials, as any other material, may have pathological effects - both the local and general type - and for an adequate assessment of the side effects that may take place, one should consider its type, severity and frequency. The author reported that the detrimental effects of mercury that emanate from dental amalgam, is a factor that contributes to the reduction of its use in many countries and increases the use of alternative products. The author has also reported that mercury does go through the placenta and, therefore, may cause harm to the fetus. However, this risk has not been verified either experimentally or epidemiologically.

In 1994, Magro et al.[12] dissertated on the safety of the use of mercury in amalgam restorations. According to the authors, the spilling of mercury onto the floor and its subsequent accumulation on the carpet and in the gaps the floor represent the highest source of vapor contamination in dental offices. The authors also emphasized that the great amount of mercury used in odontology courses suggests that the amount of mercury vapors found in colleges and clinics is higher when compared to a private practice. The awareness of the students regarding the risks and prevention while handling mercury is crucial for a safer private practice.

In 1994, Corbin & Kohw[4] researched the major findings related to the safety of dental amalgam. The authors reported that the mercury is absorbed via several different sources including food and the air we breathe.

In 1995, Saquy & Pécora[22] emphasized that the office as well as the other activities of the dental surgeon may, in time, become a threat to the health of the practitioner. The authors reported that mercury is a concern for the professionals of this area. Chronic intoxication brings inquietude, irritability, insomnia, sialorrhea, gingivitis and hand tremors. The accumulation in the nervous and renal system leads to the development of Parkinson's disease and to the deterioration of the renal system. According to the authors, the highest risk occurs during the preparation of silver amalgam and that it should follow specific instructions. In case of mercury spilling the dentist should sprinkle powdered sulfur in order to obtain mercury sulfate which is harmless to humans.

In 1977, Eley[7] reported that the first silver amalgams were attributed to Bell in England (1819) and to Taveau in France (1826) and the controversies regarding its use began as early as 1834 in the United States due to inappropriate use and to the superficial knowledge in odontolgy. The author reports that the American, the British and the Canadian Dental Associations have published statements favorable to the use of amalgam. However, Germany and Sweden have supported a planned reduction regarding its use in dental practice for environmental reasons (the contamination of the sewers).

In 1997, Eley[8] concluded that present evidence does not seem to prove that dental amalgam is dangerous to human health. However, the author recommended that when using amalgam, the practitioners should employ appropriate hygiene procedures to avoid contamination risks to themselves, to their teammates and to the environment. It seems that environmental contamination caused by mercury is the main reason for any future governmental action against the continuous clinical use of amalgam.

In 1999, Van Zyl[24] reported that the effects of the toxicity of amalgam are more likely to be found in dentists and his / her team than it is to be found in patients. The rare reactions found in some individuals are insignificant in face of the great number of amalgam restorations performed so far and these reactions are due to hyper sensibility and not due to toxicity.

In 1999, Pagani et al.[16] investigated the problem of mercury occupational and environmental toxicity, highlighting the importance of the origin of the toxicity. According to the authors, in the last few years studies have indicated that the dental amalgam toxicity is due to the release of mercury to the dentist and his / her team, to the patient and to the global environment which receives its wastes. Besides the contamination of the environment, researchers have also been worried about the fate of amalgam residues and the global environment involving mercury but also taking into consideration other sources of use.

Hsu et al.[10], in 1999, reported that acute mercury vapor poisoning is a serious problem and it is potentially fatal but it is rare and mostly found in industrial accidents. The vapor is irritating to the respiratory tract and it is also a cellular poison causing more damage to the lungs, nervous system, kidney and liver.

In 1999, Weis et al.[25] reported that one of the biggest sources of human exposure to inorganic mercury is amalgam restorations and occupational exposures. Besides being found in amalgam restorations, inorganic mercury is widely used in industrial processes and in consumer products. The physical properties of mercury make it ideal for medical purposes such as thermometers, blood pressure monitors, esophagus dilators, feeding tubes and laboratory chemicals. Industries that manufacture hospital materials and hospitals themselves are important consumers of mercury. Medical waste incinerators are the fourth largest known source of mercury emission to the environment in the United States.

In 1999, Osoborne & Albino[15] concluded a study in which they show that the amount of mercury released by dental amalgam restorations was enough to cause health problems. Although the amount of mercury vapor released during the extraction of amalgam does cause a transitory increase in the level of mercury present in the patients' body fluids, biochemical experiments have shown that this increase is too small to have a negative influence on the other organ systems. The release of mercury from dental amalgam has frequently been accused as the leading cause of a great number of health complaints. Thus, patients may return to the practitioner's office with a self-diagnosis or looking for any cause that may involve mercury. Studies that include psychological assessments seem to confirm that dental therapies that involve the removal of dental amalgam for those with the so called "amalgam disease" may have a placebo effect.

In 1999, Robertello et al.[20] tested the effects of three 10% carbamide peroxide based products regarding the release of mercury from amalgam. According to the authors, there were no significant differences between the bleaching agent group and the control group in a period of 08 to 40 hours, but in 80 hours the bleaching agents did cause a significant increase in the amount of mercury released.

In 1999, Barregard et al.[1] determined the concentration of cadmium, mercury and lead in biopsies of frozen kidney cortexes from 36 donors - 18 men and 18 women, with age average of 53. Information regarding smoking habits, professions, the presence of amalgam restorations and the consumption of fish were obtained from 27 of the donors. Those with amalgam restorations had the highest mercury concentrations in the kidneys, average of 0.47 micrograms/g, n = 20 as compared to those without amalgam restorations, average 0.15 micrograms/g, n = 6. The effects of amalgam restorations on the mercury concentration in the kidney were the expected.

In 2000, McRill et al.[14] carried out an investigation to determine the effects of beauty creams containing mercury to the human health. High levels of mercury in the urine indicate that the use of this cosmetic cream represents a significant exposure. Neuropsychiatric symptoms were frequently reported but few objective signs were observed.

In 2000, Rotstein et al.[21] evaluated *in vitro* the effects of 10% carbamide peroxide on dental amalgam restoration mercury release. A 48-hour treatment with 10% carbamide peroxide bleaching agents caused an increase in the release of mercury vapor from the restorations, possibly increasing the patient's exposure to its side effects. The types of amalgam were different in terms of the amount of mercury released after the treatment with the bleaching agent.

Discussion

Although the amalgam has largely been used in odontology for over a hundred and sixty years and, has improved its quality along these years, several studies point out to the fact that the amalgam does offer risks due to mercury toxicity. These risks can be analyzed in three different ways: occupational risk, related to the dentists and his / her team, risks to the patient and risks to the environment that collects its residues.[2, 6]

If working conditions are not adequately optimized, there are potential risks to the oral health staff because of mercury exposure. In a research carried with dentistry professionals from a health unit in the city of São Paulo, signs of altered neurological and psychological states were found in the professionals exposed to mercury along with a

mild to moderate intoxication found in five professionals, three dentists and two assistants.

The study has also identified mercurial impregnation in floor and wall tiling, in sewers, mercury leak from the amalgamator and technical procedures that were considered inappropriate during use, handling and storage of mercury[5].

Magro et al.[12] have stated that even though intoxication cases are rare, if the necessary care is neglected, serious accidents may take place. One can see that there is indeed the need for adequate hygiene procedures regarding the use of mercury along with the monitoring of mercury vapors in the working environment of dental offices as to significantly reduce mercury exposure. The authors have also highlighted that the large amount of amalgam used during the education of odontolgy students suggests that the colleges and in the clinics present a greater quantity of vapor when compared to private offices. The awareness of the students regarding the risks and prevention while handling mercury is important for a safer private practice.

The limit of occupational exposure recommended by the WHO (World Health Organization) is an average of 25 mg/m^3 for a 40-hour working week and up to 500 mg/m^3 for short time exposures[7].

The level of mercury in urine associated to the adverse effects to the health has not yet been established[11].

The measurement of mercury released from amalgam restorations became possible with the development of highly sensitive techniques. Small levels of mercury are released from amalgam restorations but the exposure to these mercury levels has not proven to be dangerous[8].

In several studies a correlation was found between the total number of amalgam restoration surfaces and the levels of mercury in blood and urine. However, the mere presence of a substance in a tissue does not imply that a toxic effect shall necessarily occur. Both the dose and the place of its concentration should be taken into account[3, 5].

Mercury evaporates from the dental amalgam surface during insertion as well as after it has been worn out[8]. The vaporization index decreases rapidly with time as a consequence of the mercury of the silver-mercury amalgam matrix[7].

Removal of amalgam restorations with high-speed instruments produces mercury vapor and an amalgam powder that contains mercury. Mercury exposure in this case may be almost totally eliminated with appropriate cooling and efficient suction but complete isolation should also be used for the removal of old amalgams. The total amount of mercury evaporated during condensation proved to be dependent on the composition of the amalgam[18, 19].

It has been recently established that the total amount of mercury that evaporates from amalgam after it has been worn out is directly related to the tin concentration in the silver-mercury matrix phase _1. In this phase, amalgams with high levels of tin release less mercury after it has been worn out[7, 9, 13].

Exposure to mercury vapor during the insertion of amalgam restorations is minimum when proper hygiene procedures are observed[12].

In Sweden the use of amalgam restorations has been prohibited. But in 1999, Van Syl[24] questioned if most of the mercury present in the human organism really comes from amalgam restorations or if it comes from the food chain, especially from the great amount of fish consumed by the locals.

Conclusion

After reviewing the literature it seems proper to conclude on amalgam that:

- People with amalgam restorations have a higher level of mercury in blood and urine but there is no evidences in the literature that these levels cause intoxication;
- The percentage of amalgam used in odontology is very small if one takes into account other sources of use;
- Mercury is absorbed from several sources such as food, the air we breathe, cosmetics and the safety margin for some individuals may be lower then that used in amalgam restorations;
- Amalgam restorations, despite the fact that they are aesthetically unsatisfactory, in the long run do show an excellent clinical quality.

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APPENDIX A – NECESSARY PREVENTIVE PROCEDURES TO MINIMIZE THE CONTAMINATION OF PROFESSIONALS, PATIENTS AND THE ENVIRONMENT.

1. Mercury should be stored in safe and closed containers away from any source of heat.
2. Any remaining residues of amalgam should be recovered and stored in an unbreakable closed container with X-ray fixing solution, glycerin or water with at least eight centimeters above the residues to cover them entirely.
3. The dental office should be designed in such a way that in an event of mercury leakage or spill the consequences are minimal allowing for immediate cleaning and should an accident occur, powdered sulfur should be applied to it as to obtain mercury sulfate harmless to the health.
4. There should be constant ventilation and cleaning of air-conditioner filters in order to keep the mercury concentration levels low, and the occupational environment should periodically be examined for these levels.
5. Only capsules that remain sealed during amalgamation should be used.
6. Skin contact with amalgam should be avoided for it could cause the mercury to penetrate the organism.
7. The removal of old amalgam restorations should be carried under refrigeration, effective suction and the use of absolute isolation.
8. Individual protection equipment such as mask, gloves and cap is advised. There should be no eating, drinking or smoking in the office.
9. The staff involved in handling mercury should be well trained.
10. All contaminated instruments should be thoroughly cleaned before sterilization to avoid evaporation of mercury due to the heat.