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SILVER AMALGAM IN THE AGE OF ADHESIVE DENTISTRY

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ABSTRACT

Education With the advent of composite resin, amalgam is no longer indicated as first treatment option. And so began a successive change in dentistry restorations which disregards the research as the longevity of a restoration. The controversy over mercury contamination emphasized this practice. Thus, this literature review study aims to guide the professional and the public about the risks of using and removal of amalgam. This material today should not be an indication of posterior restorations, but also the exchange of this for aesthetic principles and mercury contamination through the restorations does not justify this exchange. For this mercury contamination occurs mainly during manipulation and removal of the amalgam, making it necessary to observe the actual indication for such replacement, not exposing the patient / professional / risk to the environment only by the "aesthetic" factor.

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INTRODUCTION

The study and knowledge of the pathogenesis of dental caries turned Curative Dentistry Preventive Dentistry where improvements techniques and restorative materials caused the Restorative Dentistry became Dentistry in Restorative not (Busato *et al.*, 2005 and Jackson *et al.*, 2000). The new philosophies advocate the control of cariogenic pathogens and the preservation of dental structures to the successive replacement of restorations, therefore, the preservation of sound structures also boosted the development of new dental materials leading to the birth of an era even more conservative: the era Adhesive Therefore, modern restorative materials such as composite resin and glass ionomer began to be used in cavity preparations increasingly conservative, becoming a functional aesthetic viable alternative to amalgam and providing an individualization of preparation and gains in aesthetics. However, any replacement of old fillings made with silver amalgam requires a new tooth wear as well as mercury vapor release during removal can be harmful to dental staff when inhaled (Pedrini *et al.*, 2009; Silva *et al.*, 2013; Jesus *et al.*, 2010 and Grigoletto *et al.*, 2008).The amalgam, which contains 52% mercury in its composition has excellent durability and resistance (Drummond *et al.*, 2003; Saquy *et al.*, 1996 and Elizaur Benitez *et al.*, 1995), but the presence of this

chemical element in high concentrations creates a huge controversy in the areas of health and environmental, since the release of this in sewage via sucking and spitting, waste intake to the inhalation of vapor generated during removal, as well as the incorrect disposal of the material in the environment can poison the patient, the dental team, groundwater, animals and the general population (Jesus *et al.*, 2010; ATSDR , 1999; Azevedo *et al.*, 2003 and Grigoletto *et al.*, 2008).The mercury contamination is by ingestion, inhalation and by skin contact and the effect of this contamination in the oral cavity can lead to bleeding gums, alveolar bone loss, tooth loss, excessive salivation, bad breath, metallic taste, stomatitis, pigmentation in tissues and leukoplakia. Systemically when ingested can lead to the development of heart disease, respiratory, neurological, immunological and lymphatic adenopathies (Jesus *et al.*, 2010; ATSDR , 1999; Azevedo *et al.*, 2003; Grigoletto *et al.*, 2008; Ministério, 2011 and Claro, 2009).

At temperatures around 20°C mercury, which is a liquid metal evaporates and this vapor is toxic health considered dangerous, because upon being absorbed by breathing is accumulated in the body. About 80% of the total mercury is absorbed by the lungs and the remaining 20% is absorbed via ingestion and contact with skin (Reichl *et al.*, 2009; Alaves- rezende *et al.*, 2008). After inhalation, this can cross the placental barrier, reaching the fetus / embryo, and can cross the blood-brain barrier and accumulate in the central nervous system, which have a half life that can more than 12 months (Jesus, 2010;

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ATSDR, 1999; Reichl *et al.*, 2009). The amalgam fillings in the teeth also release metal vapors and Hg 2+ ions, which are vapors absorbed by the lung epithelium and carried by saliva to the gastrointestinal tract, however, this amount of mercury is not significant very least sufficient to cause poisoning, but contributes to the increase in the accumulation levels in the body, especially in dentists who work with this (Reichl *et al.*, 2009 and Alaves-rezende, 2008) material. This study aimed to guide the dental professional and his team about the care and risks of successive changes of these restorations when performed improperly, as well as emphasize the moment when this exchange is really necessary.

Literature review

The first war on amalgamation began in 1845, where the American Society of Dental Surgeons determined its members to sign a term of commitment to the wise use of silver amalgam, with the expulsion punishing those who do not adhere (Molin, 1992). At that time, few dentists believed that some other material could replace amalgam restorations and GV Black in his research on the topography of the carious lesion, postulated its principles of "extension for prevention" which required the use of a material with high strength, thus beginning research to improve the silver amalgam properties (Baratieri, 1992). In 1926 he published the first scientific article warning of the mercury risks being called by the chemical Alfred Stock in: - "Mercury Steam danger and amalgamation", initiating serious discussions based on oral galvanism (Berry, 1998) causing new amalgam alloy formulations were developed. From this they appeared alloys conventional calls or low copper content, have 4 to 6% of the metal and the high copper content alloys, which may contain from 9 to 30% (Berry, 1998).

The latter alloy has the advantage of superior corrosion resistance, as well as reducing the amount of mercury in the composition, avoiding the waste of this excess known toxic substance. This new formulation of the amalgam and the improvement of amalgamators provided a safer handling of the material associated with the fact that the alloys of high copper content do not require polishing, avoiding the heating of same and consequently mercury vapor formation (Silveira, 2000). To obtain the unique characteristics of amalgam, mercury use is indispensable in its composition, which gives it the properties of durability and easy handling. Precisely because of the presence of this chemical element, all its applicability is being discussed, not only for health reasons but for environmental reasons (Felippe, 1999). This concern began in the 50s with the great disaster in Minamata Bay in Japan where hundreds of people were poisoned by mercury discarded improperly in the sea by industry (Deus, 2013 and Osborne, 1997).

It is known that mercury from an amalgam restoration has the propensity to impregnate and infiltrate the dentinal tubules. Also known that during the chewing process, we have the release of the mercury small, around two micrograms per day in the saliva and foods, therefore, in an individual who has twelve amalgam restorations, will take about ten thousand years so that all mercury from these fillings is released (Peraire, 2011 and Campos, 2012). This amount of mercury

released is directly linked to the type of alloy used, alloys with high copper content are more stable releasing less mercury, that compared with low copper content alloys. The scientific literature shows no evidence that such levels released by the amalgam to cause contamination, since they are lower than from other sources, such as food (Campos *et al.*, 2012; Dias *et al.*, 2013 and American Dental Association, 1998). Toxic implications of mercury were extensively researched and documented, considering individuals contaminated by excessive occupational exposure as well as those who are defiled by the environment, it has been noticed not only allergic reactions, but also evidence of tremors, loss of muscle control, personality change, memory changes, insomnia, anxiety, fatigue, depression, headaches, irritability, slow nerve transmission, weight loss, lack of appetite, gastrointestinal disorders, psychological stress and gingivitis (Schhute, 1994). The dental amalgam mercury can cause infertility, reiterating a survey that showed the relationship between the total concentration of mercury in the hair of dentists and infertility (Organização, 2003; Department of Health and Human Services, 1999 and Osborne, 1995). However, Swedish researchers (Reichl, 2009 and Baratieri, 1992), in a study involving more than eight thousand results of pregnancy correlated intoxication by mercury to malformations, low birth weight and perinatal survival, and the only deviation we found was a low perinatal death rate dentists offspring compared to the total births.

Another survey also made in Sweden with 1,462 women demonstrated no correlation between amalgam restorations and cardiovascular diseases, diabetes, cancer, depression and fatigue (Sterzl *et al.*, 1996) and concluded that replacement of amalgam fillings lowers the anti-TPO antibody rates and anti-Tg in autoimmune thyroiditis patients (Dunne *et al.*, 1997). The marginal adaptation is an amalgam of advantage that in time will improve their adaptation to the tooth and better marginal sealing occurs due to accumulation of corrosion products resulting from the micro crack tooth / restoration. Thus, it can be said that an old amalgam have better margins sealed a new amalgam which does not occur in all other materials, where the marginal adaptation deteriorates over time. This factor magnifies the amalgam, with the best results compared to other materials, is this marginal sealing contributing to the low incidence of recurrent caries and infiltration in amalgam fillings (Alves-Rezende, 2008).

One of the disadvantages of amalgamation is undoubtedly the lack of adhesion to tooth structure, that causes the cavity preparations are broader and self retentive, which can lead to tooth fracture, since it is often necessary to remove healthy tooth structure to scoring the form of retention and resistance (Alves-Rezende, 2008). The dentist must keep in mind that the removal and preparation of restoration to amalgam, mercury is released into the environment and in the oral environment, and that improperly disposal also contributes to the contamination of other living beings and must be obeyed all the rules for disposal. (Aimi *et al.*, 2007) To prevent contamination of soil the ADA recommends that storage of amalgam waste is made in unbreakable and sealed containers containing sodium thiosulphate (fixing solution radiographs) in well-ventilated place and out of the consulting room; and that the office environment is easy to clean and well-ventilated (Alves-

Rezende, 2008). This liquid must be used for having sulfur, which combined with mercury, forms a very stable salt, thus preventing the vaporization of the element in question. Water should not be used for storage, because the mercury ends up evaporating beside her. (Anusavice, 2005)

The vapor of mercury has high dispersion and can be absorbed by the lungs and is very dangerous for the patient, professional and ancillary staff (Reichl, 2009 and Sterzl *et al.*, 1996). However, it cannot prohibit the use of amalgam, because there is no scientific evidence that there is a causal relationship between the amalgam fillings and health problems in the general population (ATSDR, 1999; Ministéri, 2011; Reichl, 2009; Silveira, 2000; Deus, 2013; American Dental Association, 1998 and Sterzl 1996). Imposing in aesthetic results for patients and the media incentive white teeth and invisible restorations, led to the need of the development of restorative materials used in dentistry resulting in the replacement of amalgam by more and more aesthetic materials. Dental amalgam is the material most commonly used over the last century and has been used less and less despite having a clinical proven success in restorations of posterior teeth (Cardoso, 2001). The new composites offer significant clinical performance, both in durability, as in aesthetics. This performance is due to its mechanical properties, biocompatibility, aesthetics and adhesion capability to the tooth structure (Ferracane, 2011; Manhart *et al.*, 2010), and in need of less invasive preparation preserving healthy tooth structure. However, the main causes of failure in these restorations are: secondary caries, structural and tooth fractures, marginal deficiency and postoperative sensitivity (Ferracane, 2011; Manhart *et al.*, 2010 and Berwanger, 2012).

Thus, the selection of the restorative material should be conducted with more discretion and with the participation of the patient, because the direct restorative materials, both composite as amalgam have advantages and disadvantages, which the dentist should know and explain to the patient to succeed in their treatment (Berwanger, 2012; Correa, 2012 and Kubo, 2011). The replacement of silver amalgam fillings on the other restorative material should only be performed when mainly occur the presence of secondary caries, marginal defects, infiltration, poor anatomical form, but nowadays we cannot but take into account the pressure for the aesthetic which surgeons dentists are submitted by patients (Correa, 2012 and Kubo, 2011). The removal of amalgam restoration only on the basis of their toxicity by mercury should be restricted to patients with hypersensitivity to item (Osborne, 1995; Sterzl, 1996 and Dunne, 1997). Even small changes of this material may expose the dental surgeon and his team to the risks that mercury has the attention these professionals with relatively simple security measures can contribute to the reduction of the working environment pollution and possible contamination of the various ecos^m systems, caused by mercury residues in the amalgam and disposed of in sewers and solid waste (Grigoletto, 2008).

The longevity of restorations in composite resins present variations, which can reach 10 years according to variables such as the restored area, the material used, the manufacturing technique, the oral hygiene and diet of the patient. The resin restorations are equivalent to amalgam fillings, with

significant advantages in aesthetic and less wear of tooth structure thereby increasing integrity and longevity of teeth (Sterzl, 1996; Anusavice, 2005; Demarco, 2012 and Araújo, 2014). Recent research exposes the fact that not only the overall number of restorations, both amalgam as resin has increased in recent years, but also the same number of substitutions, leading to the conclusion that longevity of amalgam restorations and composite resin can be less than its real potential, despite improvements in their physical and chemical properties (Pedrini, 2009). The repetitive cycle changes should be avoided, since during total removal of fillings has a acentuamento wear and decreased survival element (Anusavice, 2005). Thus there are many indications to exchange a restoration that include fractures, color changes and dental anatomy, secondary caries as well as restoration of function and aesthetic restorations that supposedly are faulty.

The composite material is the election today, however, although this exchange of restorative material has promoted a reduction in the use of mercury in dentistry, the replacement of amalgam has contributed to increasing environmental mercury contamination generating waste after be raised by sucking and vacuum pumps or simply running down the drain of the spittoon offices, they are dumped into the sewer system and going to the springs and soil (6.48). The dental professionals are subject to mercury exposure while performing procedures such as removing defective amalgam restoration, the disposal of excess material during the course of the restoration, in the making of new restoration, as well as contact with spray water-air resulting from high speed pen (49). In the face of all this still is the question, "- If the silver amalgam waste is a villain to the environment and health and offer little risk the patient's health that have. Why change both these restorations?"

DISCUSSION

With the evolution of restorative materials, there was a new formulation of amalgam alloys, leaving them stronger and reducing the concentration of mercury (Silveira, 2000). The low amount of mercury released during mastication, causes no apparent contamination over the years (Campos, 2012; Schhute *et al.*, 1994). Studies have shown no correlation between the occurrence of amalgam restorations present in the oral cavity and the occurrence of systemic diseases and depression (Jesus, *et al.*, 2010; ATSDR, 1999; Claro, 2009 and Greener, 1979). Dental amalgam has as property the self-sealing ability, taking advantage over other restorative materials that over time will deteriorate, leading to recurrence of cavities (Busato, 2005; Pedrini *et al.*, 2009; Silva, 2013). The composite resin restorations, have a higher incidence of secondary caries, fracture and post operative sensitivity (Ferracane, 2011; Manhart, 2010 and Berwanger, 2012). Both the amalgam as the composite resin have advantages and disadvantages (Correa, 2012). The amalgam because it contains mercury in its composition, is on trial as inappropriate, not only for health reasons in occupational exposure, but also the environmental contamination that is promoted when the removal of these restorations (Deus, 2013; Osborne, 1997 and Schhute, 1994). The constant exchange of restorations only for aesthetic factors has increased, exposing dentists professional and his team to the risks of toxic waste

amalgam. The spray of the water-air high speed handpieces during removal of amalgam (49) and mercury waste disposed of improperly in the sewer system and the vacuum suction pump and solid waste, promoting the elevation of environmental contamination (Sterzl, 1996; Anusavic, 2005; Demarco *et al.*, 2012; Araújo *et al.*, 2014). Thus, it is indicated the orientation of the patient when it asks for the return of these restorations only for aesthetic factor, the dentist has an obligation to educate the deleterious effects to health and the environment when carrying out this removal (Aimi, 2007; Cardoso, 2001).

Because, according to several authors to exchange these restorations only for aesthetic factor, it brings serious problems of environmental pollution and as consequences the grievances health of the general population, which does not justify it (ATSDR, 1999; Azevedo *et al.*, 2003; Grigoletto, 2008; Ministério do Trabalho e Empreg, 2011; Reichl, 2009; Silveira, 2000; Deus, 2013; American Dental Association, 1998; Sterzl, 1996; Aimi, 2007). Furthermore, the mercury vapors in the manufacture of a restoration or replacement decreases the rate of antibodies in patients with autoimmune thyroid (Dunne, 1997). And as seen in the literature there is no correlation between the presence of these restorations in the mouth and health problems such as cardiovascular, diabetes, cancer, fatigue, depression, among other health problems. It has been seen rather that the largest source of contamination is by ingestion of contaminated food (Schhute *et al.*, 1994), which reaffirms no indication of new amalgam restorations and not replace it by factors other than recurrence of caries, fracture of the restoration, marginal leakage fracture, infiltration (Kubo, 2011). Today with the successive changes of the restorations are wearing more sound structure than it should, the longevity of a restoration is being overlooked by the professional and the patient is at the mercy of this mercantilist dentistry.

Conclusions

Currently up it completed the amalgam fillings are crowded towards the aesthetic restorations and its replacement is mainly for this reason. The patient / professional contamination / auxiliary staff is given by mercury vapors particularly during removal of amalgam under the action of the high speed spray. Please observe the correct indication for such replacement, must not expose individuals to the risk only by the aesthetic factor. When this exchange is indicated, obey the rules for the disposal of waste and the work environment.

Competing interests

The authors declare que they have no competing interests.

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