



ASSESSMENT OF MERCURY RELEASE FROM DENTAL AMALGAM: AN IN VITRO STUDY

Shetty Aditya, Hegde Mithra N., Mathew Tony*, Bhat Ganesh

Department of Conservative Dentistry and Endodontics, AB Shetty Memorial Institute of Dental Sciences, NITTE University, Mangalore, Karnataka, India

*Corresponding Author Email: dr.tonymathew@gmail.com

Article Received on: 18/07/13 Revised on: 21/07/13 Approved for publication: 01/08/13

DOI: 10.7897/2230-8407.04847

IRJP is an official publication of Moksha Publishing House. Website: www.mokshaph.com

© All rights reserved.

ABSTRACT

Exposure to mercury from dental amalgam restoration, with possible negative health effects, has generally been considered to occur via either erosion or evaporation directly from the surface of fillings, followed by ingestion. This study aims to assess the mercury release from dental amalgam and provide a basis for comparison between mercury release in oral cavities with single and multiple amalgam restorations at different time intervals. This study was conducted in A.B. Shetty Memorial Institute of Dental Sciences, Mangalore, Karnataka, and included three groups I, II and III containing one, four and eight teeth respectively. The level of mercury vapors released from dental amalgam restorations was calculated from artificial saliva and measured using an atomic absorption spectrophotometer. The obtained results concluded that the continuous release of Hg vapor from dental amalgam tooth restorations decreases as the restoration ages, after 30 days there was no significant difference between the amount of mercury released from multiple and single tooth restorations.

Keywords: Intraoral mercury release, mercury vapor, atomic absorption spectrophotometer

INTRODUCTION

Since the early 1800's, mercury has been an important component of dental amalgams, used in various forms and compositions. It has been estimated that 75 % of all single tooth restoration are amalgam restoration and that this percentage has remained stable for many years. The ease of manipulation and placement, the relatively low cost, and the well know history of performance in the oral cavity have made dental amalgams an extremely popular restorative material. Yet, the safety of dental amalgams for both the dental patient and the dental personnel has questioned and debated intermittently since the inception of amalgam use³. Mercury vapor is released from restoration during insertion, condensation, carving and removal of amalgam.^{1,6,7,9} Mercury in dentistry has re-emerged as a contentious issue in public health, predominantly because so many people are inadvertently exposed to mercury in order to obtain the benefits of dental amalgam filling, and the risks remain difficult to interpret. Much attention is being focused upon the issue of mercury exposure from dental amalgam restorations and the potential for adverse health effects. Chronic exposure to mercury may lead to damage of the central nervous system and the kidneys.¹⁰ The controversy has grown beyond the confines of the dental profession itself and is becoming an emotional public health issue. In hope of regaining good health, many dental patients with chronic systemic diseases are considering replacement of their amalgams. Dentists are increasingly being challenged to prove the safety of amalgams. Recently, systematic methods have been established for quantitative evaluation of environmental risks. This commentary aims to examine the issue involved in assessment of the continued use of dental amalgam in dentistry. Evidence on the health effect of dental amalgams comes from studies of the association between their presence and signs or symptoms of adverse effects or health changes after removal of dental amalgam fillings. More formal risk assessment studies focus on occupational exposure to mercury and health effects. Numerous methodological issues make their interpretation difficult but new research will continue to challenge policymakers. Policy

will also reflect prudent and cautious approaches, encouraging minimization of exposure to mercury in potentially more sensitive population groups. Wider environmental concerns and decreasing tolerance of exposure to other mercury compounds (for example, methyl mercury in seafood) will ensure the use of mercury in dentistry remains an issue, necessitating dentists keep their patients informed of health risks and respect their choices.⁵

MATERIAL AND METHODS

The *in vitro* study assessing mercury released from dental amalgam was undertaken in the Department of Conservative Dentistry and Endodontics at AB Shetty Memorial Institute of Dental Sciences, Deralakatte, Mangalore, India.

Source of data

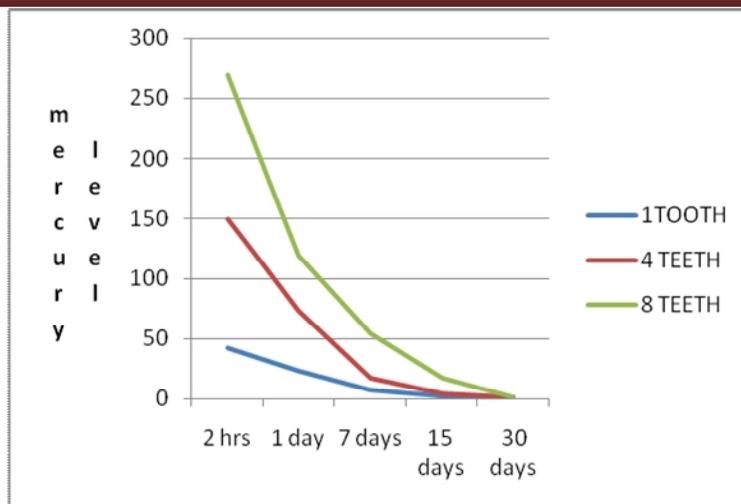
A total of 39 human molar teeth (3 in each group) were extracted and stored in distilled water containing thymol. The teeth were collected from Department of Oral and Maxillofacial Surgery, AB Shetty Memorial Institute of Dental Sciences, Deralakatte, Mangalore, India. The mercury level was analyzed using atomic absorption spectrophotometer.

Materials Used

39 Human Molar Teeth, Dentsply Dispersalloy, Artificial Saliva, Atomic Absorption Spectrophotometer (GB 932 plus atomic absorption spectrophotometer)

Methodology

Five human extracted molar teeth were stored in distilled water containing thymol. A class I tooth preparation was done in each tooth by the means of a micro motor with a Tungsten Carbide 245 bur under water spray. All cavities were standardized with 1.5 mm width and depth. The base of the cavity was flattened using inverted cone bur. Amalgam was placed using amalgam carrier and was condensed using a parallelogram condenser. Superficial rich layer filled with mercury was removed by burnishing the amalgam surface with ball burnisher.



I Graph

Table 1: Mercury Levels ng / m³

Time	Group I			Group II			Group III		
	A	B	C	A	B	C	A	B	C
2 h	42	41	42	150	149	151	270	269	270
1 Day	22	23	22	73	73	72	120	118	119
7 Days	6	7	7	17	16	16	54	55	54
15 Days	2	2	1	4	4	3	17	17	18
30 Days	0	0	0	1	1	0	2	1	1

The material was carved to follow the anatomy of the teeth, using Wards Carver. The prepared specimens were stored in plastic bottles containing artificial saliva at room temperature (37°C). The mercury level in the artificial saliva was measured using atomic absorption spectrophotometer. The specimens were measured at specific time interval (after 2 h, 1 day, 7 days, 15 days, 30 days). The result was statistically analyzed.

RESULTS

The result obtained suggests the following: In Group I When the level of mercury was measured after 2 h it measured 42,41,42 ng / m³ respectively and When it was measured after 1 day the mercury level gradually decreased to 22,23,22 ng / m³ respectively. Subsequently the mercury kept on reducing till it reached the level 0 ng / m³ at the end of 30 days in all three samples. In group II, when the level of mercury was measured after 2 h it measured 150,149,151 ng / m³ respectively. When it was measured after 1 day the mercury level gradually decreased to 73, 73, 72 ng / m³ respectively. Subsequently the mercury level kept on reducing till it reached the level 1, 1, 0 ng / m³ respectively at the end of 30 days. In group III when the level of mercury was measured after 2 h it measured 270, 269, 270 ng / m³ respectively. When it was measured after 1 day the mercury level gradually decreased to 120, 118, 119 ng / m³ respectively. Subsequently the mercury level kept on reducing till it reached the level 2, 1, 1 ng / m³ respectively at the end of 30 days.

DISCUSSION

This study was a comparative study to assess the amount of mercury released with groups containing one tooth, four teeth and eight teeth respectively, at different time intervals. According to the results obtained the following discussion can be debated. When group I was analyzed after 2 h, the

reading obtained was 42 ng / m³ whereas when group II was analyzed the reading was 150 ng / m³. Analysis of Group III produced 270 ng / m³ as its reading. The results were obtained thus because group I contained only 1 teeth, group II contained 4 teeth and group III consisted of 8 teeth. Gradually the level of mercury kept on decreasing with age, at the end of 30 days there was no significant difference between the amount of mercury released from group I, group II and group III. The results obtained were similar to a study conducted by Brune, ArneHensten – Petersen, Hans Beltesbrenke regarding the level of mercury vapors in the oral cavity. It was determined by analyzing 242 samples of intra-oral air before and after removing, setting, and polishing dental amalgam. The analysis was affected using atomic absorption spectrometry in cold vapors with the detection limit of 6 ug / m³. The study concluded that there was no significant difference of mercury vapors in the oral cavity¹. The potential health risk of mercury from dental amalgam depends on the organism's exposure and the corresponding dose. Standardization of exposure parameters, improved assessment of the Hg dose, and comparison of *in vitro* and *in vivo* tests have therefore recently been emphasized by the US Public health Service's report on amalgam (1993). The method described is a step forward addressing these priorities. Measurements of mercury release rates from the fillings serve a triple purpose: (1) They indicate exposure (2) They are basic parameters for the transformation of analytical results to dose, and (3) They may be used to assess the chemical stability of the fillings if they are standardized to surface area. Recently, conclusions drawn from the post mortem organic Hg burdens of amalgam bearers and their offspring had been based partly on sample groups from subject with =10 amalgam teeth (Drasch *et al.*, 1992,1994)². The data from this study show that the mercury released decreases as the age of the amalgam increases up to 30 days.

The same finding has been previously reported by Brune (1981) *et al* and by Derand (1989) *et al*³.

CONCLUSION

The present *in vitro* study evaluated the mercury released in three groups at different time interval. Within the limitations of this study, following conclusions were drawn:

1. As the number of teeth restored with amalgam increases the mercury released in the oral cavity increases initially.
2. As the time duration of the amalgam restored teeth increases in the oral cavity the mercury released by the teeth decreases.
3. Thus the amount of mercury released in the oral cavity by the multiple tooth amalgam restorations doesn't make a difference as at the end of one month the mercury released by one tooth restoration or multiple teeth restoration remains the same.

REFERENCES

1. Y Haikel, P Gasser, P Salek, JC Voegel. Exposure to mercury during setting, removing, and polishing amalgam restorations. Journal of Biomedical Materials Research 2004; 24(11): 1551–1558. <http://dx.doi.org/10.1002/jbm.820241110> PMID:2279986
2. S Halbach. Combined estimation of mercury species released from amalgam. J Dent Res 1995; 74(4): 1103–1109. <http://dx.doi.org/10.1177/00220345950740041101> PMID:7782541

3. E Berdouses, TK Vaidyanathan¹, A Dastane, C Weiset², M Houpt³ and Z Shey³. Mercury released from dental amalgam; an *in vitro* Study under controlled chewing and brushing in an artificial mouth. J Dent Res 1995; 74(5): 1185–1193. <http://dx.doi.org/10.1177/00220345950740050701> PMID:7790596
4. Dag Brune¹, Arne Hensten Pettersen², Hans Beltesbrekke³. Exposure to mercury and silver during removal of amalgam restorations. European Journal of Oral Sciences 2007; 88(5): 460–483. <http://dx.doi.org/10.1111/j.1600-0722.1980.tb01254.x>
5. AJ Spencer¹. Dental Amalgam and Mercury in Dentistry Australian Dental Journal 2008; 45: 224–234.
6. Richards JM, Warren PJ. Mercury vapour released during the removal of old amalgam restorations. Br Dent J 1985; 159(7): 231-2. <http://dx.doi.org/10.1038/sj.bdj.4805688>
7. NO Frykholm Acta Odontol. Scand.15, on mercury from dental amalgam: its toxic and allergic effects and some comments on occupational hygiene; 1957. p. 1-108.
8. JW Reinhardt, DB Boyer, CW Svare, WC Frank, RD Cox, DD Gay. Exhaled mercury following removal and insertion of amalgam restoration. J. Prost. Dent 1983; 49: 652-656. [http://dx.doi.org/10.1016/0022-3913\(83\)90391-8](http://dx.doi.org/10.1016/0022-3913(83)90391-8)
9. RL Cooley, WW Barkmeyer. Mercury vapor emitted during ultra speed cutting of amalgam. J. Indian. Dent. Assoc 1978; 57: 28-31.
10. Ned Tijdschr Tandheelkd. Toxic effects of mercury from amalgam fillings 1993; 100(8): 343-6.

Cite this article as:

Shetty Aditya, Hegde Mithra N., Mathew Tony, Bhat Ganesh. Assessment of mercury release from dental amalgam: An *in vitro* study. Int. Res. J. Pharm. 2013; 4(8):237-239 <http://dx.doi.org/10.7897/2230-8407.04847>

Source of support: Nil, Conflict of interest: None Declared