

Effects of Prenatal metallic mercury vapor exposure on the developing teeth of rats

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Abstract

This Study represents an attempt to investigate histologically the effect of metallic mercury vapor on the developing rat teeth after inhalation by pregnant rats .

In this study albino – wistar rats were used and divided into control and experimental groups.

The control group consisted of 8 pregnant rats, and the experimental group consisted of 12 pregnant rats. Then 20 born rats from the control group and 20 born rats from the experimental group were selected to be sacrificed at the ages of (3&13) days.

The specimens were prepared for processing and staining with haematoxylin and eosin, and examined under light microscope.

Results showed no histological abnormalities in the dental tissue of the experimental group when compared to that of the control group .

Key words : Mercury – Erupted tooth, Rat.

Introduction

Mercury and mercury compounds are widely used in modern society, several thousand scientific reports and articles in the fields of mercury , amalgam , biology and health, have been produced .⁽¹⁾

mercury Vapor from dental amalgam alone is , a biggest source to excreted mercury⁽¹⁾

The presence of raised mercury levels, does not necessarily cause pathologic reactions .The levels will have to exceed a persons threshold level, and correlation between the amount of Hg in brain and the number of amalgam fillings^(2,3)

Exposure to mercury can occur either through direct skin contact with Hg or Hg-containing compounds or through the inhalation of mercury vapor, which is the primary route of exposure⁽⁴⁾.

Mercury remained in vapor form for only limited periods because of its density and affinity for surfaces⁽⁴⁾

There are general sources of mercury in the body ug / day :

-Air :0040

-Fish 2.34

-Non-fish food 0.25

-Drinking – water 0.0035

-Mercury vapor from dental amalgam 3-17 ,

-Breast milk from fish – eating mothers can be quite high in mercury.⁽¹⁾

Materials and Methods

Twenty Albino Wistar female rats (200 – 250) mg aged (2-4) months were used in this study 12 of them were used as experimental group and 8 as control group .

Animals kept in cages, in the animal house of college of Medicine / Al – Nahrain University .

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Food pellets and water supply daily, bedding and environmental conditions were equal among all animals. The experimental pregnant rats were exposed to inhalation of metallic mercury (mercure, fluka, chemika, Switzerland). During the days (12-20) of gestation, approximately corresponding to dose of 0.07 mg Hg / m³ / for 8h on day, and the mercury vaporized from uncovered bottle, it was in the same room temperature., dental mask used by the researcher

The control group of pregnant rats were exposed to inhalation of rose water on the same days of gestation.

After delivery 20 pups were randomly selected from the newborn pups in the experimental group to be sacrificed, while for the control group 20 newborn pups were randomly selected to be sacrificed.

All Sacrificed were done using ether vapor, dividing each group into two equal subgroups by this way 10 new born rats were Sacrificed when they were 3 days old, and another 10 when they were 13 days old.

In the control group 10 rats were sacrificed when they were 3 days old and another 10 when they were 13 days old.

The teeth were extracted, decalcified, sectioned and stained using heamatoxylin and eosin, all sections were examined under light microscope by the researcher and data were recorded. Histological evaluation was done according to the criteria of Stanley^(5,6). This criteria was: 1-Remaining dentin 2-Cellular displacement 3-Superficial response 4-Deep pulpal response 5-Hemorrhage 6-Evidence of repair

Results

1- At the 3-days old rat, the experimental group show the 1st molar develop with three cusps

projections there will be process of the histodifferentiation of ameloblasts and, apposition of dentin and enamel matrix was appeared, in this age the molar showed delay in development than control group and there was slight decrease in size compared to control group. At the same time all the histological development occur in the control group, as that of experimental group (Figs 1,2)

- 2- At the 13- days in the experimental group the crown of the molar was completed and amelogenesis ended. also the apposition of dentin was clear, and the enamel matrix appeared over the cusps, these histological development and growth appeared in both control & experimental groups, without abnormalities were observed in the experimental group (figs 3,4)
- 3- The pulp cells were normal, absence of inflammatory cellular elements with normal presence of blood vessels.

Discussion & conclusions

Many dental researches and investigations had been done on the effects of the drugs on the dental tissues. Some of these experiments confirmed that many drugs may cause changes on the teeth and their supporting tissues^(7,8).

The present study was designed to evaluate the effect of mercury vapour exposure on the development of the rat dentition.

Mercury exposure was started to be inhaled by the pregnant rats 8 hours / day, during (12-20) of gestation, just before the beginning of the developmental process of the rat teeth^(9,10) and continue the exposure till the last day of gestation to see if there is any effect on the teeth structure during the odontogenesis process⁽⁹⁾.

The exposure of mercury vapour to pregnant rats using a dose (0.07 mg / m³ / day) considered as low dose and selected so as not to induce any maternal toxicity⁽¹⁰⁾. The occupational safety and Health Administration (OSHA) has set limits of 0.1mg / m³ and 0.05 mg / m³ of mercury vapour for 8 hours / day⁽¹⁾

From our results the development of the dentition of the rats demonstrated no differences between experimental and control groups except slight delay in development at 3-days old rats, which disappeared after that. This delay might be due to the alterations in growth process of the developing tooth, and had a complete recovery due to that this experiments were done upon developing tissues which are in continuous growth with time.

All experimental newborn rats manifested normal histological appearance in the developing molar teeth, no abnormalities or defect had been seen in the teeth structures including (form, shape, color, size) of cells or tissues, at 13-days old rats.

Differences among individuals in how easy mercury is transported into the brain over the blood – brain barrier could possibly lead to different mercury levels in brain in different individuals at a given whole – body dose of mercury, this could possibly explain some of the inter – individuals differences in susceptibility to mercury that is why some people get central nervous system symptoms at a given whole body dose, while other do not^(2,3)

A single dental amalgam filling with a surface area of only 0.4 cm² is estimated to release 15 micrograms of Hg / day through mechanical wear & evaporation, without causing any toxicity or abnormality to the pregnant women fetus.⁽¹¹⁾

Old mirrors could be coated with amalgam so mercury – mirror will liberate mercury as mercury vapor but again far from the amount enough to affect normal people.⁽¹²⁾

In contrast to the results of this study there are many factors that may affect the teeth development as x-ray⁽¹³⁾ laser therapy⁽¹⁴⁾, alcohol⁽¹⁵⁾, growth factor⁽¹⁶⁾ morphological changes as growth retardation or acceleration may be happened due to these factors.

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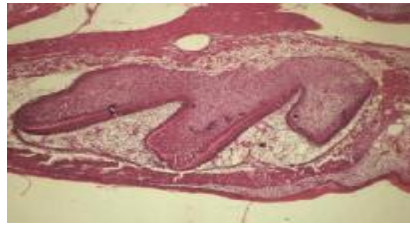


Fig -1- The developing upper 1st molar in 3-days old rat, in control group (H &E x33)



Fig -2-The developing upper 1st molar in 3-days old rat, in experimental group (H &E x33)

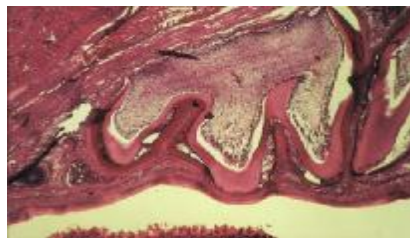


Fig -3- The developing upper first molar in 13-days old rat, in control group (H &E x33) .



Fig -4- The developing upper first molar in 13-days old rat, in experimental group (H &E x33) .