ABSTRACT

The level of lead in deciduous and permanent teeth of mentally handicapped children and adults were significantly higher than the level in deciduous and permanent teeth of normal population not exposed to lead. Lead exposure during intra-uterine life or during development may be a main factor of mental retardation.

KEY WORDS: Lead, Teeth, Mental retardation.

INTRODUCTION

Lead is a potent neurotoxin crosses the placenta to the fetus at the stage of brain development during the intrauterine life. The central nervous system of young children is particularly sensitive to the neurological damage due to excessive exposure to lead. Early exposure to lead by the fetus and the neonate is of a particular importance. Primary teeth provide evidence of lead exposure during pregnancy. It has been known for many years that neurological damage in children may results from frank lead poisoning \(^{(1,2,3)}\). Teeth lead levels are believed to give a reasonably accurate reflection of long term exposure \(^{(4,5,6)}\). The lead stored in the teeth is permanent and related to the quantity of ingested lead. Tooth lead level has been used as a measure of integrated lead exposure over time. Lead in teeth is commonly used as a biomarker of long term exposure \(^{(7,8)}\). Children with high lead concentration in teeth scored significantly less well on Wechsler intelligence scale (IQ) compared with children with low teeth level \(^{(9,10)}\). Many published studies strongly supported an inverse association between body lead burden from 10-20 µg/ d L of blood lead or 5-10 µg/gm tooth lead with an average diverst in IQ order of 1 or 2 IQ point \(^{(2,3)}\).

MATERIALS AND METHODS

Extracted teeth were collected from 48 mentally handicapped adults and children lived in the city of Newcastle upon Tyne (England) and Prudhoe Hospital for mentally handicapped patients (Northumberland country-England). Determination of lead in teeth was conducted by using heated graphite atomizer, model 2200 and atomic absorption model 460 (Perkin Elmer).
RESULTS

The ages of sample were between 9 and 64 years (Fig. 1). There were no significant differences in teeth lead level between samples collected from mentally retarded population living in the city of Newcastle upon Tyne and those mentally retarded living in Prudhoe hospital for mentally handicapped patients (Table 1). Mean tooth lead level in mentally handicapped adults was significantly higher than tooth lead level in mentally handicapped children (Table 2). The tooth lead level in mentally handicapped children and adults were significantly higher than tooth lead level children and adults of healthy reference. Population with no known risk of lead exposure who lived in the same region (Table 3). There was a significant difference in the distance between the lines, for each year of age there is a rise of 0.02313 ppm on logarithmic scale in tooth lead level (Fig. 2).

<table>
<thead>
<tr>
<th>Category</th>
<th>No.</th>
<th>Lead Concentration in teeth from mentally retarded patient Geometric mean ppm</th>
<th>Lead Concentration in teeth from mentally retarded patient Log mean ±Sd. Ppm</th>
<th>Difference between means</th>
<th>Standard error of difference</th>
<th>t</th>
<th>p</th>
<th>Sig/NS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6</td>
<td>59.566</td>
<td>1.775 ±0.395</td>
<td>0.016</td>
<td>0.631</td>
<td>0.025</td>
<td>&gt;0.9</td>
<td>N.S.</td>
</tr>
<tr>
<td>B</td>
<td>42</td>
<td>57.411</td>
<td>1.759 ±0.464</td>
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</tbody>
</table>

Table 2: Comparison of Lead concentration in teeth between:

A) Mentally handicapped children  
B) Mentally handicapped adults  
t-test

<table>
<thead>
<tr>
<th>Category</th>
<th>No.</th>
<th>Lead Concentration in teeth of mentally retarded patient Geometric mean ppm</th>
<th>Lead Concentration in teeth of mentally retarded patient Log mean ±Sd. ppm</th>
<th>Difference between means</th>
<th>Standard error of difference</th>
<th>t</th>
<th>p</th>
<th>Sig/NS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6</td>
<td>28.444</td>
<td>1.454 ±0.232</td>
<td>0.346</td>
<td>0.118</td>
<td>2.932</td>
<td>&lt;0.01</td>
<td>Sig</td>
</tr>
<tr>
<td>B</td>
<td>42</td>
<td>63.826</td>
<td>1.805 ±0.460</td>
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</tbody>
</table>
TABLE (3) Comparison between mentally handicapped children or adults and reference population not at known risk of lead exposure in terms of tooth’s lead concentration  

<table>
<thead>
<tr>
<th>Adult/children</th>
<th>Category</th>
<th>No.</th>
<th>Lead Concentration in teeth</th>
<th>Lead Concentration in teeth Log mean ± sd. ppm</th>
<th>Difference Between means</th>
<th>Standard error of difference</th>
<th>t</th>
<th>p</th>
<th>Sig./NS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children</td>
<td>Mentally Handicapped</td>
<td>6</td>
<td>28.444</td>
<td>1.454±0.232</td>
<td>0.246</td>
<td>0.124</td>
<td>1.983</td>
<td>&lt;0.05</td>
<td>Sig.</td>
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<td></td>
<td>Sample Population</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Not at known Risk lead exposure</td>
<td>137</td>
<td>16.143</td>
<td>1.208±0.303</td>
<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Adult</td>
<td>Mentally Handicapped</td>
<td>42</td>
<td>63.826</td>
<td>1.805±0.460</td>
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<td>Sample Population</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Not at known Risk lead exposure</td>
<td>126</td>
<td>18.706</td>
<td>1.272±0.372</td>
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</table>

DISCUSSION

The teeth of mentally handicapped contain significantly more lead than reference healthy population living in the region. Twenty eight percent of the difference between mentally handicapped patients and reference population was due to age; seventy two percent of the difference between the two groups was due to causes other than age. These significant differences persisted after allowing for age. The threshold for harm to the fetus due to lead exposure was not known. Previous published data showed evidence of an inverse association between tooth lead and IQ. Primary teeth obtained from cases of still birth and neonatal death of full term gestation showed evidence of lead exposure during pregnancy. High tooth lead level of the fetus may be related to lead from a high traffic intensity exposure. Other sources of lead exposure are Pica or smoking of the mother. 

FIG. (2) Tooth lead concentration V. age in mentally retarded patients and healthy reference population in the north east of england
Lead is a chemical agent that causes far more brain damage than other known teratogenic effect. The high lead tooth level among handicapped patients may be due to exposure to lead in the intrauterine life or during development \(^{19,20}\).

### REFERENCES


