ORIGINAL RESEARCH

Observation of Teeth Eruption Timings Among a Group of Children Residing Near Uranium Mines

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ABSTRACT

Introduction:Uranium is one of the most important source of energy found in India mostly used for generating electricity. People residing near uranium mines are often susceptible to various medical problems like nephrotoxicity, lung cancers, lung toxicity etc either due to inhalation, radiation or contamination through food and water. Bone is one of the susceptible tissues to be targeted by Uranium. Since bone remodeling is an important mechanism of tooth eruption, exposure to uranium and its byproducts of mining can cause a delay in tooth eruption. Hence the aim of the study was to observe the eruption timings of children residing in Gogi, Karnataka. **Methodology:** Eruption status of permanent teeth among 100 children,aged 6-12 years in Gogi village was observed. **Results:** When the eruption timing was compared with a sample from same state, there was a significant delay seen among the study group. **Conclusion**: Further study including more individuals and evaluating the uranium levels in water should be conducted to draw a definite conclusion.

KEYWORDS: Eruption, Uranium, Children

INTRODUCTION

In the recent past, uranium has gained popularity as one of the world's most important energy minerals. One of the sources of exposure to uranium for the population is the intake of water or foods contaminated with uranium which is found in the environment as a result of uranium mining. Uranium can accumulate in bone and affect bone metabolism in laboratory animals, and when ingested in drinking water, can increase urinary excretion of calcium and phosphate which are important components of the bone structure. Uranyl nitrate, fluoride, arsenic, vanadium are few of the by-products of uranium mining reported throughout the world. The inhibitory effect of uranylnitrate(UN) on bone formation can be seen in mandibular growth, post extraction alveolar wound healing and in tooth socket remodelling. All these reports and findings instil an inquisitive among the medical researchers to enlist the various health issues of the miners and their families and the local inhabitant of the area around mining. Several studies have been conducted to enquire about the health of people around limestone, coal, etc mining areas. But little has been known about the people around uranium mines. Almost no study has been attempted worldwide concerning the oral health status of children residing near the uranium mines. Tooth eruption and further development are ongoing processes that begin during the foetal life and any change in the environment during this period will hamper the normal development of teeth.There is hardly any published data regarding eruption timings of children residing near uranium mines. Hence, this study was carried out with an aim to find out whether there exists any correlation between eruption timings in children with the availability of uranium in the surroundings.

MATERIALS AND METHODS

One hundred children from Gogi village, in Yadgir district of Karnataka, aged 6-12 years were included in the study group. Any child who was not born in the village or has recently shifted to the village was not considered. Examination of each individual was done using a mouth mirror and probe under natural light(type III examination)[1].The examination of teeth started from the maxillary right quadrant for the presence of permanent teeth followed by the maxillary left, mandibular left quadrant, and mandibular right quadrant. The number of permanent teeth erupted in each quadrant in the oral cavity of each child was recorded. A tooth with any of its parts emerged through the gingival in the oral cavity was considered as erupted. If there was doubt, the area was dried with cotton to confirm the eruption.[2]

RESULTS

The study sample consisted of 100 children in the age group of 6 to 11 years out of which 37 were boys and 63 were girls (Table 1).

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Age	gender		Total
	Male	Female	
6	4(10.8%)	3(4.8%)	7(7.0%)
7	4(10.8%)	9(14.3%)	13(13.0%)
8	1(2.7%)	3(4.8%)	4(4.0%)
9	13(35.1%)	19(30.2%)	32(32.0%)
10	7(18.9%)	19(30.2%)	26(26.0%)
11	8(21.6%)	10(15.9%)	18(18.0%)
Total	37	63	100

Table 1: Distribution of study population

When the number of permanent maxillary and mandibular teeth erupted in different age groups were examined, it was found that children who were of six years of age did not show presence of any permanent teeth(Table 2). Among the six year children from the

Age /tooth	16	14	12	11	21	22	24	26
6	0	0	0	0	0	0	0	0
7	7(53.8%)	0	3(23.1%)	4(30.8%)	4(30.8%)	3(23.1%)	0	7(53.8%)
8	4(100%)	0	2(50.0%)	3(75.0%)	3(75.0%)	2(50.0%)	0	4(100%)
9	31(96.9%)	2(6.3%)	24(75.0%)	27(84.4%)	27(84.4%)	8(25.0%)	2(6.3%)	31(96.9%)
10	26(100%)	3(11.5%)	25(96.2%)	26(100%)	26(100%)	25(96.2%)	3(11.5%)	26(100%)
11	17(94.4%)	2(11.1%)	17(94.4%)	17(94.4%)	17(94.4%)	17(94.4%)	2(11.1%)	17(94.4%)
Total	85(85%)	7(7.0%)	71(71.0%)	77(77.0%)	77(77.0%)	55(55.0%)	7(7.0%)	85(85.0%)

Table 2: number and percentage of permanent maxillary teeth erupted at different age

control group at least 1.9 % of the children showed the presence of mandibular central incisors and 0.4% maxillary incisors, 0.7% showed the presence of mandibular lateral incisors, 0.2% maxillary lateral incisors and 6.4% showed presence of first mandibular permanent molars and 5.9% maxillary first molars. Among the seven year children, 30.8% children showed presence of central incisors and lateral incisors and first molars were erupted in 53.8 % of children. There was no difference seen among maxillary and mandibular teeth. Among the seven year children in the control group 5.4 % children showed presence of maxillary central incisors, 2 % children showed lateral incisors and 14.3 % children showed maxillary first molars(Table 3). Among the 8 year children, all children showed presence of central incisors, lateral incisors, and first molars. Among the 9 year old children only two children i.e, 6.3% showed presence of maxillary first premolars where as at least 4% of children showed presence of maxillary first premolars in control group. Only 1 child (3.1%) showed presence of mandibular first premolar in contrast to 0.2% of control group. Among the same age group at least 1% showed presence of maxillary canines, 0.3 % showed mandibular canines and 0.3% showed mandibular second premolars where as no individual in the study group showed presence of canines and second premolars at this age(Table 4). Among the 10 year old children, 11.5% of

Age/ tooth	36	34	32	31	41	42	34	46
6	0	0	0	0	0	0	0	0
7	7(53.8%)	0	4(30.8%)	4(30.8%)	4(30.8%)	4(30.8%)	0	7(53.8%)
8	4(100%)	0	4(100%)	4(100%)	4(100.0%)	4(100%)	0	4(100%)
9	32(100%)	1(3.1%)	28(87.5%)	29(90.6%)	29(90.6%)	28(87.5%)	1(3.1%)	31(96.9%)
10	26(100%)	2(7.7%)	26(100%)	26(100%)	26(100%)	26(100%)	2(7.7%)	26(100%)
11	17(94.4%)	1(5.6%)	17(94.4%)	17(94.4%)	17(94.4%)	17(94.4%)	1(5.6%)	17(94.4%)
Total	86(86.0%)	4(4.0%)	79(79.0%)	80(80.0%)	80(80.0%)	79(79.0%)	4(4.0%)	85(85.0%)

Table 3: number and percentage of permanent mandibular teeth erupted at different age

Age (yrs)	Central incisors(%)	Lateral incisors	canines	First premolars	Second premolars	First molars	Second molars
5 M F	0 0	0 0	0 0	0 0	0 0	0 0	0 0
6 M F	7(0.4%) 10(0.5%)	3(0.2%) 2(0.1%)	0 0	0 0	0 0	134(6.1) 144(5.9)	0 0
7 M F	100(5.9) 107(5.4)	28 (2) 43(2.4)	0 0	0 0	0 0	312(14.3) 333(13.5)	0 0
8 M F	171(10.1)	72(5.1)	0 0	0 0	0 0	278(12.7) 246(10)	0 0
9 M F	233 (13.7) 214(10.8)	147(10.4) 158(9)	1(0.2) 2(0.2)	6(7) 5(4)	0 0	267(12.2) 231(9.4)	0 0
10 M F	187(11) 190(9.6)	177(12.5) 177(10.1)	14(2.2) 19(1.9)	65(7.3) 69(5.6)	20(3.1) 16(1.6)	190(8.7) 191(7.8)	4(1) 4(0.5)
11 M F	345(20.3) 370(18.6)	334(23.6) 361(20.5)	120(18.7) 149(14.6)	234(26.3) 263(21.2)	122(18.7) 151(15)	345(15.8) 372(15.1)	35(8.5) 58(7.9)

Table 4: eruption timings of maxillary teeth among control group

group had shown the presence of maxillary first premolars and 5.6 % of mandibular first premolars in contrast to 5.6 % of maxillary first premolars and 5% of mandibular first premolars. In the same age group at least

1.6 % of maxillary second premolars, and 0.5 % of maxillary first molars and 2.2% of mandibular second premolars, 3.7% canines, 1.1% mandibular second molars whereas none of the children in the study group among the same age group showed any presence of maxillary and mandibular second premolars, canines and second premolars and second molars. Among the eleven year old children, in the study group,11.1% showed presence of maxillary first premolars and 5.6% in contrast to 21.2% maxillary first premolars, 18.9% mandibular first premolars. In addition the eleven year children in the control group showed presence of 14.6% maxillary canines, 15% maxillary second premolars and 7.9 % maxillary second molars and 18.3 % mandibular canines, 16.2 % mandibular second premolars and 9.1% mandibular second molars whereas none among the study group showed presence of canine, second premolars and second molars (Table 5).

Age (yrs)	Central incisors	Lateral incisors	canines	First premolars	Second premolars	First molars	Second molars
5 M F	0 0	0 0	0 0	0 0	0 0	0 0	0 0
6 M F	34(1.8) 41(1.9)	9(0.5) 13(0.7)	0 0	0 0	0 0	147(6.7) 159(6.4)	0 0
7 M F	189(9.8) 191(8.8)	72(4.4) 74(3.9)	0 0	0 0	0 0	316(14.3) 336(13.6)	0 0
8 M F	245(12.7) 208(9.6)	152(9.2) 127(6.9)	0 0	0 0	0 0	283(12.8) 246(10)	0 0
9 M F	265(13.8) 227(10.5)	223(13.5) 200(10.5)	5(0.7) 4(0.3)	10(1.2) 2(0.2)	4(0.6) 3(0.3)	269(12.2) 230(9.3)	0 0
10 M F	188(9.8) 190(8.8)	187(11.4) 187(9.8)	27(3.8) 42(3.7)	58(6.9) 59(5)	25(3.7) 22(2.2)	190(8.6) 191(7.7)	7(1.4) 9(1.1)
11 M F	346(18) 366(16.9)	344(20.9) 364(19.1)	147(20.6) 209(18.3)	202(24) 225(18.9)	129(19.3) 165(16.2)	345(15.6) 368(14.9)	44(9.1) 84(10.2)

Table 5: eruption timings of mandibular teeth in control group

**Adapted from "Patil K, Lakshmappa A, Guledgud M. Eruption times and patterns of permanent teeth in school children of India. Indian Journal of Dental Research. 2011;22(6):755."

DISCUSSION

Eruption timings have been studied among the various normal population, among different health problems and medical conditions. Various scenarios that show a delay in eruption are lack of space , sequalae of trauma, ankylosis of primary predecessors, supernumerary tooth, dilacerations, cysts, tumors and systemic conditions like endocrinoapthies, syndromes and other hereditary and idiopathic causes.

According to James K Avery, tooth eruption is the movement of the teeth through the bone of the jaws and the overlying mucosa to appear and function in the oral cavity.[3] In a study done by M MPujadas Bigi,[4] on experimental rats, reduced tooth development was observed in the experimental animals. This effect was thought to be caused by a toxic effect of uranium on hertwig's sheath cells, odontoblasts and cementoblasts. The delay in tooth eruption and a decrease in tooth development caused by oral administration of uranyl nitrate observed in that study [5] were relevant findings in view of the increasing risk of oral intoxication with uranium due to environmental contamination of water and fertilizers, especially during early stages of tooth eruption. Bone remodelling theory of tooth eruption hypothesizes that eruption of teeth is mainly due to selective deposition and resorption of bone around the dental follicle.In an experiment done by A.M Ubios,[6] showed that uranium has the potential to alter bone remodelling by attaching to the cell membrane and in turn affecting the osteoblasts, that could release soluble mediators for bone resorption.

In the present study, eruption dates were calculated and compared with the control group as a percentage of the sample size. Owing to the small population of the village and the lesser availability of children attending schools, the sample size was restricted to 100, a statistical comparison of eruption timing with a huge population could not be done. Since the sample was distributed randomly among study group and total sample was less compared to the control group, a large variation was seen among the two groups. Hence, it was more reliable to check for the unerupted teeth among the different age groups to compare the eruption timings. The maximum age for a tooth eruption among the control group including both girls and boys were taken as a reference value to increase accuracy. There was an overall delay in eruption of incisors and molars seen among the child. In the control group, the sequence of the eruption was 6-1-2-4-5-3-7 depicting that first premolar erupted earlier than canine, which was similar in the present study. Therefore, it can be hypothesized that there is only a delay of eruption of teeth and not change in sequence. This delay of eruption is also noticeable when compared to recent AAPD guidelines[7] and a study done in Madurai by Sajeev Slater et al.[8]

The reason could be the presence of uranium in the drinking water or food at a very early age or to pregnant mothers, during the maturation of ameloblasts or in other stages of enamel formation. Bone is the only tissue in which uranium is found to significant amounts after a certain time[9] and is considered the critical organ in chronic exposure[10]. It is well documented that since one of the mechanisms of tooth eruption is bone remodelling, there is always a possibility that these children showed delay in eruption due to exposure to uranium. Moreover, when compared with a group of children of the same age group and from the same state to avoid any environmental discrepancies, the children in the study from Mysore showed earlier eruption timings. Few drawbacks or limitations which were faced during the

study was, a small sample size could be involved owing to the lesser population and readiness of people to participate. Ever since the uranium mining was started various controversies regarding health hazards are being proposed, some of which might be just a myth. Uranium is an important source of energy and uranium mining could promote the economic development of the country and solve various other problems. The study was done not to demote the usefulness of mining but to create awareness about the prevailing effects so that proper handling of waste materials can be done and people residing near those areas could take as many precautions possible. More studies should be conducted in various parts of India where uranium mining is carried out to draw a definite and generalized conclusion regarding the relationship of presence of uranium and tooth eruption.

CONCLUSION

When the eruption timings of children from the study group in Gogi, Karnataka were compared with the control group from the same state, a noticeable delay was seen among the study group.

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