Radioactivity - Risk Factor in Oral Health and of Structural Dental Anomalies

CODRUTA VICTORIA TIGMEANU[1#], RAMONA AMINA POPOVICI[1], ANCA PORUMB[2*#], ANGELA CODRUTA PODARIU[1], LAVINIA ARDELEAN[1], IUSTIN OLARIU[3], ION VIRGIL CORLAN[1], MIHAELA FLORICA ADOMNICAI[1], ALEXANDRA ROI[1]

[1]Victor Babes University of Medicine and Pharmacy Timisoara, Faculty of Dental Medicine, Department I, 2 Eftimie Murgu Sq., 300041, Timisoara, Romania

[2]University of Oradea, Faculty of Medicine and Pharmacy, Department of Dental Medicine, 10, 1 Decembrie Str., 410068, Oradea, Romania

[3] Vasile Goldis West University Arad, Faculty of Dental Medicine, 94 Revoluiei Blvd., 310130Arad, Romania

The dentition goes through a complex process of development, a process that can be influenced by internal and external factors. Our study was perfomed on a group of 1673 children from different areas in Bihor county. The uranium mining exploitation in this specific area is very popular, but with an unfortunate consequence: pollution. This factor has had a great impact upon the workers, but also the surrounding areas. The aim of the present epidemiological study is to evaluate the incidence of dental anomalies upon the targeted group and to identify the correlation between the impact of the pollution upon the development of the dentition. All the data was obtained during a clinical examination, documented and afterwards statistically analyzed. Our study concluded that the examined subjects presented with a high percentage of structural dental anomalies, with an average incidence in the polluted areas that can be explained by the interactions that occur and the influence of the radioactive substances upon the development.

Keywords: Pollution, uranium, dental anomalies, incidence, radioactivity.

When we talk about the development of the dentition we must take into consideration that the development process is a complex one, that can be highly exposed to various internal and external factors. There are important stages during the process of development that can be affected by genetic or environmental or an influence of both can cause important alterations that can lead to dental anomalies of number and structure.

In the present study, our focus group in located in Oradea, Bihor county, an area that is largely exposed to uranium. The uranium mining exploitation is very popular in this area, and the fast development of the mining activity has led to an increased pollution factor that had a big impact upon the population from the surrounding places [1]. The concerning in regard to this important aspect stood up as a motivation towards the need to evaluate and asses the risk of the development of dental anomalies among the population. The main activity of exploration, exploitation and proceesing of the uranium has arisen in Bihor county in 1949. The important research work has started in 1950, when the ore at Baita became one of the greatest uranium mining exploitation in the world, from 1950 to 1960 [2]. Although the continuous evolution of the industry was welcomed, it also had a negative impact upon the concerning pollution factor. The progress could be quatified in the development of several cities as ªtei and Nucet, Baita village and Baita-Plai. The positive fact that came along with the growth of the industry influenced the standard of living and civilization in the villages nearby [1].

The elements that could be found were radioactive, with a few chemical, physical characteristics of other elements as well, being mainly responsible for the pollution.The main radioactive substances that could be found and be involved in the pollution process are: genuine uranium (pollution of the air and water), radium 226 and radon 222 (found in maximum concetration) [3,4].The radioactivity can be quatified due to the the presence in air, water, soil, vegetation, animals and especially the human body of certain substances with a radioactive potential. It has been certified that during the last 50 years the natural radioactivity of this specific locations presented significant variations due to an incresed human involvement [4,5].

The contamination involved the occupationally exposed workers, but also the population from all the surrounding area, being mainly possibile due to the fact that all the radioactive elements of the uranium family had a leading role in the pollution factor [6]. A working enviromental that implies radioactive ore extraction can lead to major additional risks and exposures for the workers, the pollution itself can spread and determine the existance of a high risk area, including for the living population nearby [7]. The importance of pollution by radioactive elements derivated from the uranium family can be evaluated according to each environmental factor in particular, being considered that the most affected factor is water [8]. The importance in the use and release of these water in this specific area raised an important concers regarding the health of the population [9]. A continuous evaluation of the water in order to determine the radioactive charge became in the last years a matter of a great interest, especially when its purpose was for domestic use.

In almost all areas where the mining industry has developed, it accumulates over time in the leaves or fruits of spontaneous flora or crop plants, heavy metals, and radiocations, depending on the metal content of the mined ores. Prolonged exposure of plants to high concentrations of heavy metals such as radioactive or sterile copper-containing uranium may become a potential hazard to consumers and their health. Accumulation of metals with toxic potential is mainly in the leaves of plants considered

* e-mail:anca.porumb@yahoo.com #Authors with equal contribution

important in health (thyme, mint, sage, sweet wood, sea buckthorn and blackberries, etc.). They are harvested by locals and used in folk medicine. In the case of forest fruits (sea buckthorn and blackberries) from the spontaneous flora or those grown around the mining areas, they have the potential to accumulate toxic metals in much larger amounts in the leaves of the plants, compared to those of the fruits). It is recommended that plant extracts obtainable from medicinal plants in these areas should not be used for medical purposes or incorporated into pharmaceutical or para-pharmaceutical products [17].

As a radioactive substance approximately 1%-2% of ingested uranium is absorbed in the gastrointestinal tract. During its pathway, uranium enters quickly in the bloodstream and forms a diffusible ionic uranyl hydrogen carbonate complex ($UO2HCO3+$) which is in equilibrium with a non-diffusible uranyl albumin complex [10]. Regarding the uranium accumulation, the bones and the kidneys are the first to be affected. It is reported that high doses of uranyl nitrate has an important influence in the tooth eruption, causing delays, influencing also the mandibular growth and development due to the nocive effect upon the targeted cells [10]. Other adverse health effects reported by clinicians and involve individuals with known exposure to uranium include: reactive airway disease, neurological abnormalities, rashes, lymphomas, neuro-psychological disorders and gum tissue problems [10].

The aim of the present epidemiological study is to evaluate the incidence of dental anomalies in the 3 areas of Bihor County, taking into consideration the fact that they have different degrees of pollution. The targeted areas are Stei (high concentration uranium), Beius (used as a comparison, having the same altitude but with different geological surface) and Oradea (used as a witness group).

Experimental part

Material and method

Our study included a number of 1673 children distributed into 3 different groups: 608 children from Oradea, 471 children from Beius and 594 children from Stei (fig. 1). The inclusion criterias were: both sexes, ages between 7 and 15, based on the following facts: age 7-9 years is representative for the time the temporary incisors are substituted, frequently causing anomalies in the incisive area; between age 9-12 the second premolars are predisposed to malpositions; and 12-15 years when the second molars should erup, with a high change of anomalies. The exclusion criterias were children age >15 years, children with other congenital pathologies.

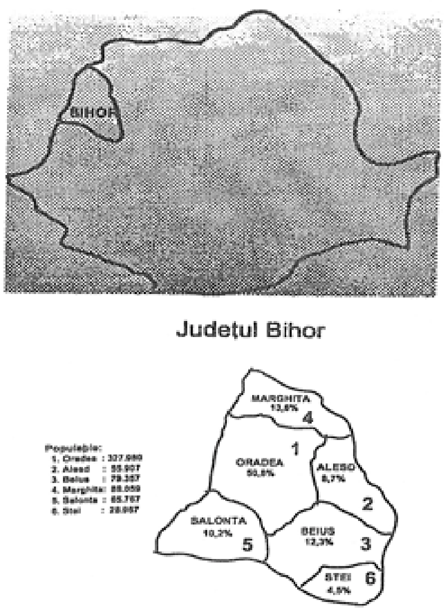

Fig.1. Bihor County

The examination of the subjects included in the study was performed in the scholary dental offices based on a conventional dental examination. For each subject a specific dental chart was filled in. On the chart's dental formula all the abnormal changes were marked, such as the absence of one/more teeth, anomalies of number, shape and volume, odontal treatments. It could not be quatified the frequency of the anodontia of the third molar and from the data obtained during the clinical examination; a differential diagnosis was not possible regarding the analysis of the impacted teeth or the delayed eruption (no radiographic examination was performed).

All the data that was obtained during the clinical examination and documented with the dental chart was afterwards statistically processed. The statistical analysis was performed using a specific program and the information was distributed based on more categories: age and sex of the subjects, geographic area, maxilar/ mandibular teeth (unilateral or bilateral) and group of teeth (incisors, canines and premolars).

Results and discussions

All the data was statically analyzed based in different variables. From a total of 1673 examined children, 936 of the were boys and 737 girls (fig. 2).

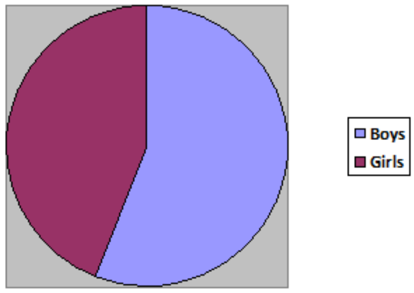

Fig.2. Gender distribution of the subjects included in the study (Boys= 936; Girls= 737)

From the information obtained during the clinical examination and documented in the dental charts, the structure disorders had a significant higher prevalence in ªtei area, than in Beiuº or Oradea. Also, the prevalence of the structure disorders had a higher rate in boys than in girls ($p = 0.876$, $p = 0.119$, respectively $p = 0.093$) (fig.3).

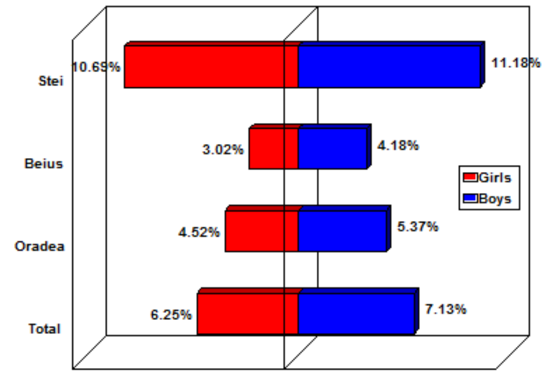

Fig.3. The prevalence of structural disorders based on gender and the three different groups

In this study, nine types of dental anomalies were quatified in order to determine their prevalence regarding each of the three locations (table 1).

In this manner, a correlation between their incidence and the degree of the pollution of the specific area can be made (fig.4).

	Stei	Beius	Oradea
Hypodontia	12 children	5 children	9 children
Supranumerary teeth	1 child	0	1 child
Rotations	55 children	157 children	126 children
Transpositions	8 children	4 children	6 children
Impactation (reimpactation)	4 children	2 children	3 children
Ectopy	6 children	3 children	5 children
Structure anomalies	65 children	17 children	30 children
Macrodontia	32 children	10 children	21 children
Microdontia	39 children	7 children	14 children

Table 1
GENERAL DISTRIBUTION OF THE NINE DENTAL ANOMALIES BASED ON THE 3 DIFFERENT LOCATIONS

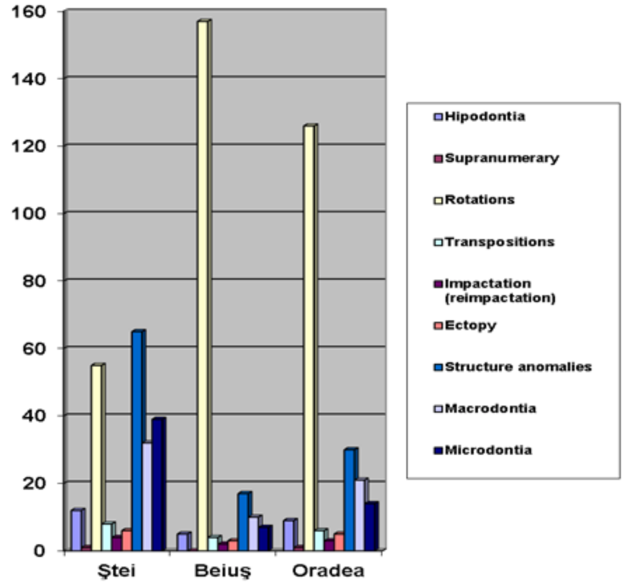

Fig.4. The prevalence of dental anomalies

Taking into consideration the dystrophies, their percentage varied in relation to the group of teeth affected and their localization (upper or lower jaw). The incisor-canine group proved to have a higher incidence regarding the occurrence of dental dystrophies in comparison to the molars or premolars (fig.5). Also, the dystrophies in the incisor-canine group were more encountered in the lower jaw (fig.6).

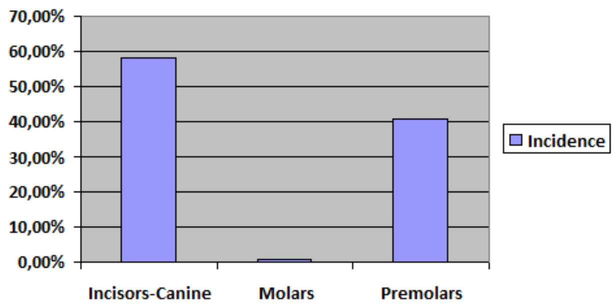

Fig.5. The incidence of dental dystrophies

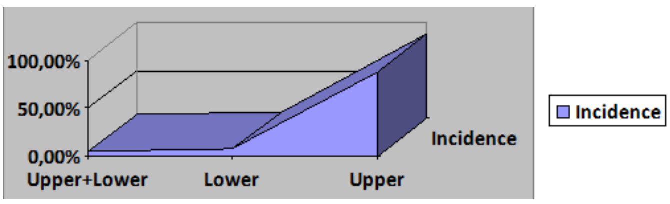

Fig.6. The prevalence of dental dystrophies in the canine-incisive group in relation with the upper and lower jaw

In the premolar area, the dystrophies percentage is different in relation to the localization (upper or lower jaw) and the position (unilateral or bilateral) (fig.7).

The incidence of hipodontia also proved significant differences and distribution in the cases that were included in our study. After the analysis, the statistic showed that a high incidence of hipodontia is related to the group from Stei area, with the involvement equally of both genders (fig. 8).

The incidence of supranumerary teeth was of a 38 case in Stei and 24 case in Oradea. In Beius area non from the cases that were included in the study were affected by this number anomalie (fig. 9).

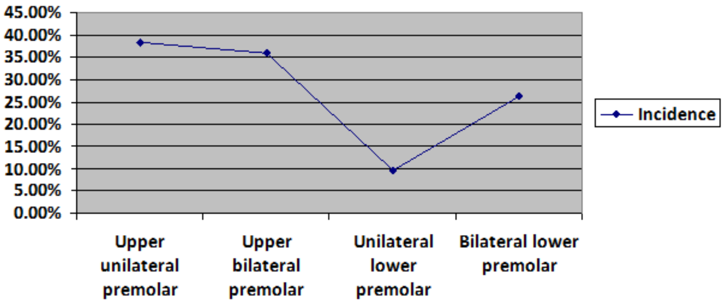

Fig.7. The incidence of dystrophies in the premolar group

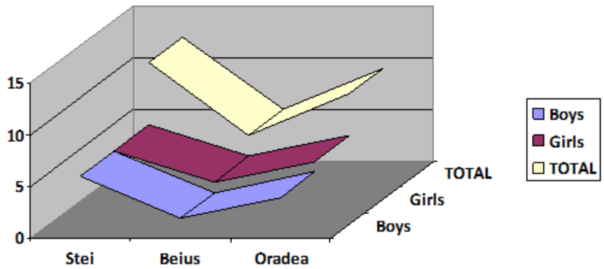

Fig.8. Incidence of hipodontia

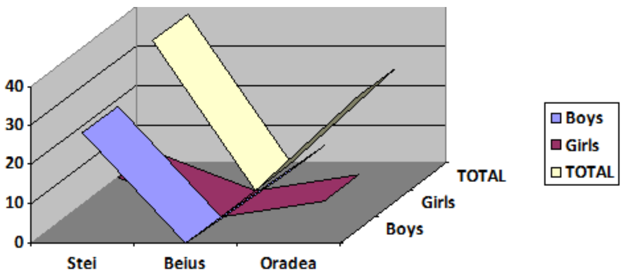

Fig. 9. The incidence of supranumerary teeth

The transpositions were found to have a higher incidence in Stei than in Oradea or Beius, with a total of 19 cases from 31 of transpositions (fig. 10).

Structural anomalies of the teeth had a high incidence among the subjects included in our study. A number of 290 cases of structure anomalies were identified, the majority in Stei area, respectively 112 cases (fig. 11).

The structural dental anomalies are not the only health problems that people have in the polluted area of Stei, until

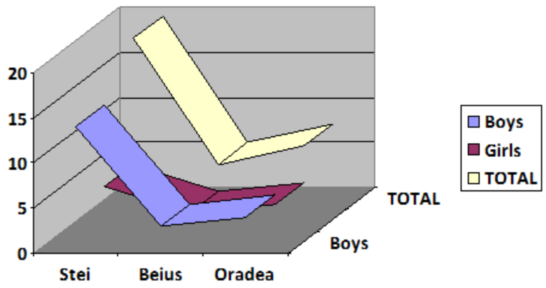

Fig. 10 The incidence of transposition

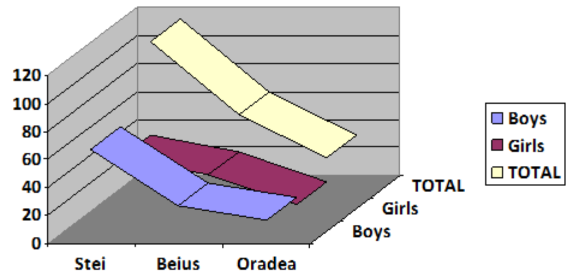

Fig. 11 The incidence of structure anomalies

now the studies have identified the fact that there is also a high incidence of pulmonary cancer, with a 4.5 times higher than other areas. Also, there has been reported that congenital heart malformations in this area have a higher incidence than other nearby areas [11]. Regarding the incidence of dental anomalies, the irradiated area of ªtei proved to have an important influence in their appearance, the reports proving that the incidence is higher than the one reported in other studies from the literature [12-15].

A general statistic performed by Boboc [16] after personal experience has shown that 28.69% of the patients with orthodontic treatment had dental anomalies : supranumerary teeth 3.49%; anodontia 2.18%; isolated rotations 0.33%; transpositions 0.87%; impaction 2.73%; canine ectopy 16.36% [16].

In another study performed on a group of 201 children, the following statements can be affirmed: 143 cases had canin-premolar transposition, 40 cases canine-lateral incisor transposition, 8 cases canine-first molar, 6 cases of transposition lateral incisor-central incisor and 4 cases with canine-central incisor transposition [17].

Regarding the incidence of supranumerary teeth, the data from the literature exposes different values reported by each author: CHATEAU: 1%, GRAHNEN 2.6%, 1-5% COCARLA, 3% BOBOC [16]. In relation with the gender of the patient, the available data until now reveals the fact that supranumerary teeth appear more often at males than females, with a incidence of 2:1.

The incidence of hipodontia differs depending of each author's research regarding dental anomalies: 0.7% PLAETSCHKE; 3.4% DOLDER; 3.5% MULLER; 4.9% KOVACS; 6.1% GRAHNEN, 4-5% COCARLA; 2.18% BOBOC; 4.35% DOROBAT; 8% TARMURE , BOLD (13.1 %) [16]. Hipodontia is relatively frequent nowadays. It cannot be told if this observation is due to an efficient method of anomalies detection or is a real fact that suggests that the occurrence of dental anomalies is very high. In our study that included 1673 children, 158 with hipodintia, confirms again the fact that their frequency is in a continuous growth.

Conclusions

It can be concluded that a variety of serious health issues can be found in irradiated areas such as ªtei, and structural dental anomalies are among them. A high percentage of dental dystrophies can be identified in this specific area, and their incidence can be explained by the polluting factors that coexist and influence the normal development of children and adults.

Acknowledgement: P III-C4-PCFI-2016/2017-04 and Bridge Grant PN-III-P2-2.1-BG-2016-0455/122BG.

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Manuscript received: 16.01.2018