Ethical Aspects in Pediatric Radiology

CODRUTA VICTORIA TIGMEANU[1], ANCA PORUMB[2]*, ALEXANDRA SABINA PODARIU[1], MIHAELA FLORICA ADOMNICAI[1], CRISTIAN DAN KREMS[1], VIRGIL CIOBANU[3]*, SIMINA CAMELIA DEJICA[3], ANGELA CODRUTA PODARIU[1]

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

[2]University from Oradea, Faculty of Medicine and Pharmacy, Dental Medicine Departament, 1 Universitatii Str., 410087, Oradea Romania

[3]Victor Babes University of Medicine and Pharmacy Timisoara, Faculty of Medicine, 2 Eftimie Murgu Sq, 300041, Timisoara, Romania

Pediatric dentistry has become, in recent decades, a freestanding discipline, from the desire to improve dental assistance offered to children. It is a highly complex medical specialty, involving the triad of minor patient, doctor and the legal guardian of the patient. In conformity with European Community law, Law no. 95/2006 of Romania says it will get a written consent from the patient or his legal guardian; the methods of prevention, diagnosis and treatment of potential risk to the patient. Minor patient will be informed during the process of making decisions according to his understanding skills, (Law 46/2003), the final decision for acceptance the treatment belongs to the parents (consent of one of them is sufficient) or the legal guardian and the consent must be given in a written form (Law 95/2006; Bucur S.& al 2014). But conception as well as the doses used in pediatric dentistry are different from those used for adults. This paper aims to aware of dentists on ethical issues related to the indication of making child patient dental radiographs, in conformity with the recommendations and radiological current European rules (Guidelineson the use of dental radiographs, 2003).

Keywords:ethics; practical guideline; dental radiography; child, pediatric dentistry.

.

The American Academy of Pediatric Dentistry (AAPD), through the Commission of Pediatric Radiology provided a Radiological guidance adopted in 1981, revised in 1992, 1995, 2001, 2005, 2009 and reaffirmed in 2012. This guide was developed to help practitioners make clinical decisions on proper selection of dental radiographs, as part of a proper oral assessments in infants, children, adolescents, persons with special needs and health care. The guide can be used to optimize patient care, minimize the dose of radiation and to allocate health care resources in a responsible manner. American Dental Association (ADA) has initiated a review in terms of *patient selection for X-ray examinations: radiological dental exams* in 2002 [1,5]. AAPD, together with other dental specialty organizations, participated in the revision of these guidelines. The Food and Drug Administration (FDA) accepted them in November 2004.

In 2006, the ADA Council on Scientific Affairs has published an update of recommendations for dental radiographs[2, 8].

The AAPD continue to subscribe and take into account the recommendations of the ADA and FDA. Dental radiographs are valuable radiological exams in oral health care for children and adolescents. They are used to diagnose the pathology of the oral cavity and to monitor the development and progress of dentofacial treatment. Recommendations and guidelines of the ADA-guide/ FDA have been developed to serve as an adjunct to the professional judgment of the dentist[3].

Initial radiological examination calendar should not rely only on the age of the child, but also on the individual characteristics of each child. Because each child is a unique patient, the need for dental radiographs can only be determined after considering the child's medical and dental history, a thorough clinical examination and assessment of patient vulnerability to environmental factors that might affect oral health [4,7].

Dental radiographs, from an ethical standpoint, need be indicatet only when it is considered that they will bring more information and will confirm a clinical diagnosis made previously presumed. AAPD recognizes that there may be clinical situations in which a radiography is indicated, but a diagnostic image can not be obtained. For example, the patient is unable to cooperate with the dentist. If radiographs are impossible to obtain, the dentist should discuss with the parent to determine appropriate management techniques (e.g prevention interventions/ restoration), considering the relative risks and benefits of different treatment options for the patient.

Because the effects of radiation exposure is cumulative over time, it is a moral and ethical duty of every dentist to make the effort to minimize exposure of child patient. Appropriate radiological practices such as the use of lead aprons, thyroid collars, high-speed films, more sensitive to radiation and digital sensors are extremely important. The dentist has a moral duty to weigh the benefits versus the risk of obtaining dental radiography radiation exposure to the patient-child. Medical imaging technologies, such as cone beam CT (CBCT), added three-dimensional (3D) capabilities that have many applications in pediatric dentistry [9].

Utility and future of the CBCT were revised, guidelines are emerging in organizations like the American Academy of Oral and Maxillofacial Radiology (AAOMR).

Charter Guidelines for Prescribing Dental radiographs, elaborated by the American Dental Association, US Food & Drug Administration stresses that the recommendations of this charter are subject to clinical reasoning. So it is a moral and ethical duty of every dentist to indicate a radiological examination only after an anamnesis of the

* email: anca.porumb@yahoo.com, Phone 0726286237; vciobanu2000@yahoo.fr

patient and a complete thorough clinical examination. In this sense, the dentist will indicate the type of dental x-ray that will require minimum radiation. It will be used protective apron and thyroid collar, especially recommended for children, pregnant women and young mothers.

European Association of Pediatric Dentistry (EAPD) has developed a guide for the use of dental radiographs in children. In dental radiology guidelines are designed to avoid unnecessary exposure to X-radiation and to identify individuals who may benefit from a radiological examination. Every dental radiography indication should be based, from an ethical standpoint, on an assessment of each patient's individual benefit. Routine radiographs examination could not demonstrate that it is capable of providing sufficient information to be justified, given the balance between costs (radiation and resources) and benefits. Dental radiography is a useful complementary diagnostic tool in the examination of children, in many cases, radiological examinations bringing important information. However, the risks associated with conducting a dental X-rays should not be neglected.

Dental radiology guidelines are intended to avoid unnecessary exposure to X-radiation and to identify those who may benefit from a radiological examination. From an ethical standpoint, when an X-ray is indicated to a pediatric patient it must take into account the keywords such as: appropriate selection criteria for a particular type of radiography, optimal radiation protection and getting a maximum amount of information with minimal radiological irradiation. European Association of Pediatric Dentistry (EAPD) has established guidelines for pediatric radiography. After EAPD, the most important reasons to indicate dental radiographs in pediatric dentistry are in number of 4. These are: 1) detection of caries; 2) dental injuries; 3) tooth development disorder; 4) examination of pathological lesions other than decay.

For each patient, the clinical exam should be performed before initiating a radiological examination indication. There should be an individual indication for a specific type of x-ray that is why guidelines of EAPD should be used as a helpful tool. In the conception of EAPD, radiological examination should not be regarded as a routine examination, using the same procedures for all individuals, both the children and adults[6, 15,17]. Radiographs should only be performed when a patient history and / or symptoms and objective findings lead to the conclusion that more useful information can be obtained. Unless additional radiographic information is expected to change the diagnosis, treatment plan or add other information, dental radiography, in terms of ethics, should not be indicated. EAPD has also established principles for radiographic examination of asymptomatic children.

Informed consent

In our country, the Code of Medical Ethics (Chapter II), Law 46/2003 (Chapters II and III) and Law 95/2006 (Chapter III) stipulates, on one hand, the patient right and / or his legal representative to medical information (on his health, medical interventions necessary, their risks, the existing alternatives the proposed procedures, including the default of treatment and non-compliance with medical recommendations and data on diagnosis and prognosis), on the other hand the obligation of the patient/ legal representative through informed consent on medical intervention. Practically in the informed consent, in heading for other laboratory exams will be explicitly mentioned the radiological examination with radiographs type requested. Also for underage patients, informed consent is enough to be signed by one parent.

The patient or the parents have a legitimate right to be informed and to accept the dentist advise about any x-ray or screening procedure that could be discussed. The dentist has the moral duty to consider and respect the preferences of the patient and/ or family, but only after they have received and understood the information provided. However the dentist may recommend some type of radiological investigation if it considers that the examination is very beneficial for the patient. From an ethical standpoint, it is important for clinicians to be aware of the guidelines recommendations that are generally accepted, and if they are not followed, the reasons should be discussed with the patient and recorded in the clinical history of the patinet [12].

Radiography, besides the patient record and study model it represents forensic documents that are preserved in original by the doctor, copies may be given to the patient if they wish for. Modern technology allows even radiographs multiplication, attachment to email and many other variants. In cases of malpractice, patient's informed consent is only a legal document without medical value, but the radiography has forensic connotation, medical and legal implications, representing conclusive evidence for or proving the professional malpractice. The absence of informed consent of the patient involves a malpractice in terms of medical ethics.

EAPD emphasizes that bitewing radiographs provide excellent information for detecting dental caries [11]. Over the past 2-3 decades, they were made a number of changes on bitewing radiographs. There has been a revision in terms of ionizing radiation dose and was decided to use lower doses, particularly for children. All these changes have an impact on the point of view regarding when and how often it should be indicated to pediatric dental radiographs. These changes have resulted in a statement saying that each of the dental x-ray indication should be based on an evaluation of benefits for each patient. In other words, the indication of routine dental radiographs or screening purposes is no longer justified.

However, this statement is ambiguous and could mean different things. As extreme interpretation, dental radiographs are never indicated for detecting cavities. So that the population will not be exposed to the slightest dose of ionizing radiation. The other extreme is that any new caries should always be suspected and therefore frequent bitewing radiographs are necessary. It would be desirable to use a pragmatic interpretation as a guide and try to make useful in clinical situations. Bitewing radiographs benefits that aid the diagnosis of dental caries are caries detection that can not otherwise be detected under the point of contact and estimation lesions extension. From an ethical standpoint, advanced radiography and dental radiographs of good quality are vitally important in this way.

How to minimize patient exposure?

The radiation dose should be be maintained at a low level how much it can be reasonable both for the patient and for the technician operator. Usually, there will be no clinically significant damage caused by a lower dose of X-rays in dental radiography. However, modern radiation protection suggest that any radiation dose has the potential to cause biological damage. It is impossible to state that any specific dental exposure produce any specific cancer. All we can say is that the evidence suggests that even very low doses carry the potential to cause cancer [11].

The probability of long-term effects (stochastic effects) of radiation exposure increases with dose. The probability of cancer is related to radiation dose, but when the disease appears, the severity of the disease will not depend on the radiation dose. As younger the person is, the vulnerability to radiation is higher due to the number of cell divisions that occur at young children. The International Commission on Radiological Protection (ICRP, 1991) showed that the cancer risk of illness is reduced when using the fastest available films or digital radiography, because they use lower doses of radiation [16].

Protecting patients

Dental films are marketed, as defined by the International Organization for Standardization [ISO 1996], in variants speed D (slower) and E (faster). E speed films are more sensitive to radiation and should be used, because there has been no loss of diagnostic information. This was demonstrated using Kodak films Ektar Speed Plus (Speed E group) instead of Kodak Ultraspeed (Speed group D) slower. Kodak recently introduced intraoral film InSight (Speed group F), which claims to reduce dose by 20%. They should use protective lead aprons, thyroid collar both for child and for the accompanying person, if it assists during his exposure[20,22]. Intraoral radiographs could be a frightening experience for the child.X-ray cone generator is placed near the face and an unpleasant film is placed intraoral[10]. It must be explain the child what will happen and the techniques should be used to reduce fear[21]. Important cooperation with the child reduces the need to repeat the radiography! Some measures to reduce radiation are listed in the following table (table 1).

Table 1
THE EFFECT OF VARIOUS TECHNICAL MEASURES TO REDUCING RADIATION DOSE TO THE PATIENT [11]

Technical measure	Approximate reduction in dose to the patient
Digital system (Phosophor plate) vs. E-speed film	75%
Rectangular vs.circular collimator	50%
Digital system (CCD) vs. E-speed film	50%
Long cone vs. short cone	50%
65kV vs. 50kV set	50%
E-speed vs. D-speed film	40%

Digital Radiography

Digital Radiography require lower doses of radiation compared to the E-films. Several improvements of filmmakers are reducing the exposure time of 20-60%: charge-coupled systems Devices (CCD) and 50% (phosphor imaging plates)[13,14].

Sensors charge coupled devices (CCD) are usually lower than conventional films. Patient comfort was also mentioned as unfriendly especially when systems were used for children. In conclusion, digital radiography has advantages over conventional radiography, but bulky systems sensors with attached cable are clinical inconveniences. There are no studies available on the use of digital radiography for children, but it seems that at present the benefits of these systems are canceled by disadvantages such as acceptance of the sensor. In the future, improved devices can be expected, but for now, high speed classic films, 2/3 cm size variation used in place of ¾ cm in adults may be more suitable for young children[18].

Extraoral radiographs

In specialized clinics, for maxillofacial radiography, advanced techniques such as computer tomography, are commonly used. In practice, panoramic radiography is frequently indicated in pediatric dentistry, when an overall assessment of the patient's jaw and teeth is needed, but the image resolution is not so fine as intraoral radiography, so that the radiographic quality of the teeth is lower. The radiation dose is relatively low and the method is convenient to use for pediatric patients. However, it requires a sufficiently long exposure and children can move during the exposure. Sometimes, extraoral radiographs will be completed for some areas with intraoral radiographs.

Experimental part

Material and method

In the study, a Dosimeter Giger Counter Nuclear Radiation Detector X-Ray Beta Gamma Detector was used to identify the level of radiation after performing a panoramic X-ray or CBCT (measured in μSV).

The study results were divided into doses recorded for panoramic radiographs, CBCT restricted to a small volume (dento-alveolar) and cranio-facial CBCT (table 2).

Patients were not recommended for a specific radiology center, but only for the type of radiological investigation.

The study was prospective, and were included 127 patients, the both sexes were the same represented (see table 3), the mean age was 37.4 ± 18.4 year, and the most representive age category was 18- 25 year (table 4). Majority of the study group have batchlor degree, 66.9% (table 5), and are employees 40.1% (table 6).

	Panoramic radiograph <8,3 conform ICRP 2007	CBCT dento-alveolar	CBCT craniofacial
Effective dose/μSV	2.4-21	10-392	30-203

Table 2
EFFECTIVE DOSE RADIATION IN RADIOLOGY SERVICE

		N	%
Sex	female	63	49.6
	male	64	50.4
	Total	127	100.0

Table 3
SEX CARACTERISTICS OF THE STUDY GROUP

Table 4
AGE CARACTERISTICS OF THE STUDY GROUP

		N	%
Age catgory	18-25 year	41	32.3
	26-39 year	30	23.6
	40-49 year	21	16.5
	50-59 year	11	8.7
	60-69 year	12	9.4
	70-79 year	12	9.4
	Total	127	100.0

Table 5
EDUCATION LEVEL OF THE STUDY GROUP

		N	%
Education level	Without education	1	0.8
	gymnasium	9	7.1
	highscool	32	25.2
	Betchlor degree	85	66.9
	Total	127	100.0

		N	%
Ocupation	employee	52	40.9
	enemployed	3	2.4
	Free lencer	48	37.8
	pensioner	24	18.9
	Total	127	100.0

Table 6
OCCUPATIONAL DISTRIBUTION OF THE GROUP

Results and discussions

The results are quite large, but the overall range is within the accepted international limit. No gender, age, gender variations can be made, and variations are not specific to a particular group of patients in the study (table 7).

67.7% of patients believe that dental x-rays are not recommended in pregnant women, and 28.3% do not. 3.9% believe that dental x-rays can be performed in pregnant women. Age categories of 18-25 years and 26-39 years of age are the best represented percentage (table 8).

When patients and their parents or caregivers ask about radiation doses, they are in fact concerned about the associated risks. There are different ways to communicate radiation doses and the risks associated with a specific pediatric imaging procedure. Comparisons with more radical radiation exposure are often used [19,24-26]. For example, radiation doses in medical imaging are often communicated as multiple chest X-rays. Although the e*quivalent number of X-rays* can help to understand the magnitude of exposure, comparison with such low doses can be misleading and useless if it is not properly explained. Also, comparisons are made between radiation doses in medical procedures and the equivalent exposure time to natural background radiation. Natural background radiation results in whole body exposures, while exposure to radiation in medical imaging is focused on a region of the body. This should be explained when we make such comparisons.

The average radiation dose absorbed by each of us:

- Annual mean dose = 3600 uSv / year
- Daily mean dose = 10 uSv / day

According to a study by Harvard Medical School, a panoramic radiography = 10 uSv, equivalent to one day of natural exposure

Although the flight rates due to cosmic radiation depend on the flight path (latitude, altitude, and duration) and show seasonal variations, the total effective effective dose for a transatlantic flight is 50 μSv [25]. Comparison with such low doses may be misleading and should be carefully explained. Radiation risks can be compared to the equivalent levels of risk associated with day-to-day activities, such as street driving or driving a car [26]. Determining the most appropriate comparisons for a particular patient should be based on the particular situation, on the unique perceptions of the patient and the parents, as well as on the personal preferences and abilities of the health professionals.

In dental medicine, radiological bone level evaluation is very important for every clinical situation, for hard and soft tissue affected [27,28].

The message refers not only to facts but also to the way in which the facts are presented. When considering the benefits and risks, there is an important risk that is often forgotten: the risk of not conducting an exam that can lead to the loss of a diagnosis and the initiation of treatment too late to improve the medical outcome. The potential to improve a patient's life is to estimate early diagnosis and treatment as compared to the extent of cancer risk and latency compared to patient age and other comorbidities.

Patients and caregivers often personalize risks, even when scientists are trying to depersonalize them. This is particularly common if the public has a low understanding of radiation protection concepts or statistics in general. For example, a *one-in-a-million* comparison to express the risk of cancer could be perceived as a low risk by the scientific community. However, patients, parents and caregivers can personalize the risks and perceive that *one* might be they or their loved ones (EPA, 2007). This risk personalization tendency can be seen more often in stressful situations, such as when an imaging procedure is required for a child.

There is substantial evidence for a relationship between exposure to ionizing radiation and subsequent development of salivary gland tumors. The tumorigenic effects of head and neck radiation on the salivary gland tissue were assessed at Michel Reese Hospital in Chicago. The average annual incidence per 100,000 people was 48 cases in an

			Perception about harmful effect			Total
			Very harmful	harmful	Low harmful	
Age category	18-25 year	N	5a	25a	11a	41
		%	3.9%	19.7%	8.7%	32.3%
	26-39 year	N	5a	21a	4a	30
		%	3.9%	16.5%	3.1%	23.6%
	40-49 year	N	3a	12a	6a	21
		%	2.4%	9.4%	4.7%	16.5%
	50-59 year	N	1a	6a	4a	11
		%	0.8%	4.7%	3.1%	8.7%
	60-69 year	N	2a	5a	5a	12
		%	1.6%	3.9%	3.9%	9.4%
	70-79 year	N	2a	7a	3a	12
		%	1.6%	5.5%	2.4%	9.4%
Total		N	18	76	33	127
		%	14.2%	59.8%	26.0%	100.0%

Table 7
AGE DISTRIBUTION OF PATIENTS AND PERCEPTION OF THE HARMFUL EFFECT OF X RADIATION

			perception of dental x-ray recommendations in pregnant women			Total
			yes	no	Don't know	
Age	18-25 year	N	1	31	9	41
		%	0.8%	24.4%	7.1%	32.3%
	26-39 year	N	1	24	5	30
		%	0.8%	18.9%	3.9%	23.6%
	40-49 year	N	2	12	7	21
		%	1.6%	9.4%	5.5%	16.5%
	50-59 year	N	1	5	5	11
		%	0.8%	3.9%	3.9%	8.7%
	60-69 year	N	0	10	2	12
		%	0.0%	7.9%	1.6%	9.4%
	70-79 year	N	0	4	8	12
		%	0.0%	3.1%	6.3%	9.4%
Total		N	N	86	36	127
		%	%	67.7%	28.3%	100.0%

Table 8
AGE DISTRIBUTION OF PATIENTS AND PERCEPTION OF DENTAL X-RAY RECOMMENDATIONS IN PREGNANT WOMEN

early period but increased to 77 per 100,000 people later in the study [7].

Conclusions

Guidelines in dental radiography are designed to avoid unnecessary exposure to X-rays and identify those who can benefit from a radiological examination. The routine radiographs, except dental caries, were shown not to provide sufficient information to justified their performance, by putting in balance the costs (radiation and resources) and benefits. From an ethical standpoint, when dental radiographs are indicated for children, it must taken into account the keywords such as selection criteria for some type of radiography, optimized radiation protection and getting a maximum amount of radiological information with minimal radiation. Dental radiography is more delicate in pediatric dentistry, because the size of the adult dose is not suitable for children. Ethical and moral is needed that when a x-ray is indicated to a child patient, to take into account the current European radiological recommendations [1,2]. From the ethical standpoint, when we use dental x-rays to pediatric patients ,we must be delicate in terms of radiation doses, because that's too much damage! (More is often not better!).The radiography, besides the patient record and study model represents forensic documents to be stored in original by the doctor, it may be make copies that can be given to the patient if they wish [5, 8]. In cases of malpractice, patient's informed consent is a legal document only, without medical value. The forensic radiography connotation, medical and legal implications, representing conclusive evidence for demonstration of professional malpractice. Lack of informed consent of the patient requires a malpractice in terms of medical ethics, which has no connection with the professional malpractice. But no matter in which part of medical practice lies malpractice, ethical or professional malpractice still remain from legal terms.

References

1.***LAW 95/2006, published in Official Gazette 237/05/04/2007.

2.***LAW 46/2003 on patient rights, published in the Official Gazette, Part I, No. 70 of 03.02.2003

3.BUCUR, S.M., CHIBELEAN,M., (CHERRY WEINER), PACURARI, M., SITA, D.D., ZETU,I.N., Ethical considerations in Orthodontics and dentofacial orthopedics - Romanian Journal of Bioethics Vol 12, No 1, January-March 2014, pg. 80 -84.

4.***GUIDELINES ON THE USE OF DENTAL RADIOGRAPHS - Adopted in 2003.

5.***AMERICAN ACADEMY OF PEDIATRIC DENTISTRY, Guideline on Prescribing Dental Radiographs for Infants , Children, Adolescents and Persons with Special Health Care Needs –Reference Manual, 2006 v 36, no 6, pg 314-316.

6.CEAUSU, A.R., CIOLOFAN, A., CIMPEAN, A.M., MAGHETI, A., MEDERLE, O., RAICA, M., The Mesenchymal-Epithelial and Epithelial –Mesenchymal Cellular Plasticity of Liver Metastases with Digestive Origin, Anticancer Research, V 38, Issue 2, pg 811-816, DOI 10.21873/ANTICANRES. 12288

7.***AMERICAN DENTAL ASSOCIATION, US Dept of Health and Humans Services. The selection of patients for dental radiographic examinations- 25 June 2012.

8.***AMERICAN DENTAL ASSOCIATION COUNCIL ON SCIENTIFIC AFFAIRS. The use of dental radiographs. Update and recommendations. J Am Dent Assoc 2006; 137(9):1304-12.

9.CARTER, L., FARMAN, A.G., GEIST, J., ET AL. American Academy of Oral and Maxillofacial Radiology executive opinion statement on performing and interpreting diagnostic cone beam computer tomography. Oral Surg Med Oral Pathol Radiol Endod 2008; 106(4):561-2.

10.FARMAN, A.G., SCARFE, W.C., HASKELL, B.S., Cone beam computer tomography. Seminars in Orthodontics 2009; 15(1):1-77.

11.ESPELID, I., MEJARE, I., WEERHEIJM, K., EAPD guidelines for use of radiographs in children, European Journal of Paediatric Dentistry 1/2003, pg 40-48.
12.***AMERICAN ACADEMY OF PEDIATRICS COMMITTEE ON BIOETHICS. Informed consent, parental permission and assend in pediatric practice. Pediatrics. 1995;95(2):314-17
13.TILLETT, J., Adolescents and informed consent: ethical and legal issues. J Perinat Nurs. 2005;19(2):112-21.
14.***AMERICAN COLLEGE FOR DENTISTS Decision Making, Ethics. Handbook for Dentists. Introduction of Ethics, Professionalism and Ethical Decision Making, (ed.), 2008.
15.TITA, I.C., TITA,B., TOMA, C.C., MARIAN, E., VICAS, L., Thermal Behavoiur of Valsartan Active Substance and in Pharmaceutical Products, Rev.Chim.(Bucharest), **68**, no. 10, p 2307-2310
16.OSAKWE, H., NICOLESCU, C., NICOLESCU, L., HOINOIU, B., MEDERLE, O., MUSSUTO, E., POPOIU, C., BOIA, E., The Impact of Residual Bowel After Extended Bowel Resection on Bacterial Overgrowth and Bacterial Translocation, Rev. Chim. (Bucharest), **69,** no 8, p 2121
17. SAVIN, L., LUPESCU, O., PATRASCU, A., MIHAILESCU, D., GRIGORESCU, V., ZLATE, T., MIHAI, D.N., GRIEROSU, C., BOTEZ, P., Implanting the Prosthetic Components Based on Radiologic Planning in Deformities of the Knee in Valgus, Mat. Plast., **54**, no.1, p 79
18. PODARIU, A.S., PODARIU, A.C., POPOVICI, R.A. Communication Strategy on Oral Health Education for Adolescents. Revista de Cercetare si Interventie Sociala, 58, 68-80.
19.CHIVU, O.R., MEDERLE, O., SEMENESCU, A., ET AL. The Determination of the Noise Pollution in a Production Hall and the Diseases Produced by It, Rev. Chim.(Bucharest**), 69,** no. 4, p. 875.
20. POPOVICI, R.A., PODARIU, A.C., ANCULIA, R.C., SERAFIN, A.C., TIGMEANU, C.V., KREMS, C.D., LEVAI, M.C. Accessibility to Dental Health Care: Risk Factor in Oral Health at Rural Area Community. Revista de Cercetare si Interventie Sociala, 59, 48-61.
21.***AMERICAN COLLEGE FOR DENTISTS Ethics. Handbook for Dentists. Introduction of Ethics, Professionalism and Ethical Decision Making, 2008.
22.GAVRILOVICI, C., Highlights of current bioethics: human rights in medicine, Romanian Journal of Bioethics 3 (4), 2005.
23.OPREA, L., An analytic review of the doctor-patient relationship, part I. Romanian Journal of Bioethics 2009; 7 (2): 125-37.
24.RIVIS, M., PRICOP, M., TALPOS, S., ET AL, Influence of the Bone Cements Processing on the Mechanical Properties in Craioplasty, Rev. Chim. (Bucharest), **69,** no 4**,** p 990
25.SENDREA, C., CARSOTE, C., RADU, M., BADEA, E., MIU, L., The Effect of Gamma Irradiation on Shrinkage Activity of Collagen in Vegetable Tanned Leather Rev.Chim.(Bucharest), **68,** no. 7, p.1535
26.JINESCU,V.V., MANEA, S.E., JINESCU, C., The Result of Loads Superposition Upon the Matter and Particularly Upon the Environment, Rev.Chim.(Bucharest), **68,** no. 4, p.656
27.GALUSCAN, A., CORNIANU, M., JUMANCA, D., FAUR, A., PODARIU, A., ARDELEAN, L., RUSU, L.C., Evaluation of Marginal Periodontium Adjacent to the Reconstruction Materials in the Dental ProstheticsStudy Morphopathologycal and Immunohistochemical, Mat. Plast, **49**, no. 2, p. 85
28. RUSU, L.C., URECHESCU, H., ARDELEAN, L., LEVAI, M.C., PRICOP, M., Comparative Study for Oral Reaction Produced by Polymethyl-methacrylate, Mat. Plast., **52,** no. 3, p. 413.

Manuscript:14.03.2018