Attitudes of staff involved in dental radiological procedures in Georgia towards radiation protection and Safety - a questionnaire-based study

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Abstract

Objectives: To investigate dentist's perceptions and attitudes regarding radiation safety in dental practices in Georgia.

Methods: More than 100 dentists involved in dental X-ray diagnostic procedures across the country participated in this study. The questionnaire was submitted via Google form, a total of 17 key questions with relevant sub-questions. Further data were evaluated according to the frequency distribution. An anonymous survey was conducted regarding the following areas: years of practice, types and characteristics of the radiography equipment, knowledge of BSS and national regulations, prescription of dental radiographs, use of radiation protection equipment, participation in the radiation safety training program and etc.

Results: The obtained data are presented in the form of tables and diagrams. Analysis of the answers showed a fairly high level of knowledge and responsibility for radiation safety among all survey participants. A certain difference in the answers depends both on work experience, education and on a number of other factors, for the study of which additional research is needed.

Conclusions: This article is the first study in Georgia conducted jointly by a scientific organization, a national regulatory authority, as well as educational and professional structures. The analysis of the results of the presented questionnaire, on the one hand, allows the assessment of mandatory knowledge of radiation protection and safety issues of the target personnel. On the other hand, such feedback based on statistical data is a prerequisite for the revision of possible further regulatory requirements. Staff awareness issues involve the involvement of the relevant professional associations, which will allow it to strengthen the requirements for its members in the long run, as well as better analyze existing practices.

Keywords: radiography; dentists; radiation; protection.

Introduction:

Dentistry today is one of the rapidly developing areas of medicine, and in recent years, an increasing number of different methods have been used to help patients. Almost all of them require the use of diagnostic imaging methods, most of which in modern dentistry are based on the use of ionizing radiation. At the same time, it should be borne in mind that dentistry is a field of medicine where the number of patients is very large. And, accordingly, the number of patients exposed to ionizing radiation is large. As in the rest of the world, in Georgia, all these modern trends in dentistry are clearly traced, and accordingly, along with this, the number of diagnostic procedures using ionizing radiation has significantly increased in the country in recent years. Justification and optimization as well as other aspects of radiation safety in dental radiography are now very important for dental practitioners in terms of radiation dose reduction. This requires a permanent update of knowledge in this area, their correct application in practice and multilateral control over it. This is difficult to implement without interconnected and coordinated activities of Regulatory Bodies, Professional Associations, Educational and Scientific Organizations. This publication is the first coordinated study in Georgia by Regulatory Bodies, Professional Associations, Educational and Scientific Organizations using a jointly developed questionnaire, which aims to provide an initial assessment of the attitude of personnel involved in dental radiological procedures in Georgia towards radiation protection and safety.

Materials and Methods:

The study includes a survey of over one hundred dentists across Georgia using a jointly developed Google-based questionnaire that was sent out by email. Any direct contact with respondents was excluded; during the study, all international and national COVID-19 regulations were observed. The questionnaire included 17 main questions and sub-questions presented in Table 1. Each question of the questionnaire gave the opportunity to choose from several answers. The confidentiality of the respondent was strictly guaranteed, the survey form included a one-time distribution of the questionnaire and receiving answers.

Table 1.

Number	Question/ SubQuestion	Possible Answers
1.	Please indicate the period of work as a radiologist (X-ray laboratory technician, Physician radiologist)?	a. 1 - 5 years b. 5 - 10 years c. More than 10 years
2.	Do you have the relevant qualifications of a radiologist?	a. Yes * b. No.

2.1	**SubQuestion:** If yes, please specify:	respondent's own answer
3.	Have you been trained in nuclear and radiation safety issues?	a. Yes * b. No.
3.1	**SubQuestion:** If yes, does the knowledge gained from the training help you manage your, other staff and patient safety, as well as to inform the patient (e.g. about radiation risk / benefit, patient consent to the procedure, etc.)?	a. Yes * b. No.
3.1.1	**SubQuestion:** If yes, please specify:	respondent's own answer
4.	Are you aware of the national legislative requirements in the field of radiation safety?	a. Yes * b. No.
4.1	**SubQuestion:** If yes, indicate the source of knowledge acquisition	a. Radiation Safety Program b. Internet resources c. Training program d. Other; Specify:
5.	Please indicate the type of dental X-ray machine you are using in practice:	a. Intraoral b. CT / Panoramic c. Both
6.	Which radiographic examination is prescribed to an adult patient who first comes to your clinic?	a. Usually intraoral radiography that focuses on the patient's painful area b. Usually panoramic radiography c. Radiographic examination is not prescribed d. Usually, both panoramic and intraoral radiographs, focusing on the patient's painful area
7.	Which radiographic examination is prescribed to a pediatric patient who first comes to your clinic?	a. Usually intraoral radiography that focuses on the patient's painful area b. Usually panoramic radiography c. Radiographic examination is not prescribed d. Usually, both panoramic and intraoral radiographs, focusing on the patient's painful area e. Radiographic examination is not prescribed
8.	Do you use the patient's radiation protection facilities (e.g. lead apron, thyroid collar)?	a. Yes b. No. c. Not available
9.	Do you use an individual personnel dosimeter?	a. Yes (specify the type of dosimeter) *

		b. No. c. Not mandatory in dental practice
9.1	**SubQuestion:** If yes, do you know the annual effective dose taken by you?	a. Yes * b. No.
9.1.1	**SubQuestion:** If yes, how long have you been conducting individual monitoring?	a. 1 year or less b. More than 1 year c. Specify the exact period
10.	From what distance is the image taken by the operator?	a. 2.5 m from the pipe b. Directly to the machine c. Comes with a specific situation
11.	Are you aware about the liquidation plan of the radiation incident, accidental radiation prevention and possible consequences?	a. Yes b. No. c. Not available
12.	Does the damage accompany the dental radiographic examination?	a. Yes b. Insignificant c. No. d. I do not know
13.	Are X-rays reflected from the walls of the room during dental radiography?	a. Yes b. No. c. I do not know
14.	Do you have information about the use of collimators and filters in dental radiography?	a. Yes b. No. c. I have no information
15.	Have you heard about deterministic and stochastic effects?	a. Yes b. No.
16.	Do you know the ALARA principle?	a. Yes b. No.
17.	Has contraindication a dental radiography examination in pregnant patients?	a. Yes b. No. c. I do not know

Results:

Fig. 1. Please indicate the period of work as a radiologist (X-ray laboratory technician, Physician radiologist)?

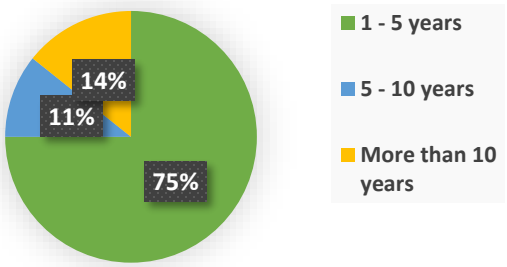


Fig. 2. Do you have the relevant qualifications of a radiologist?

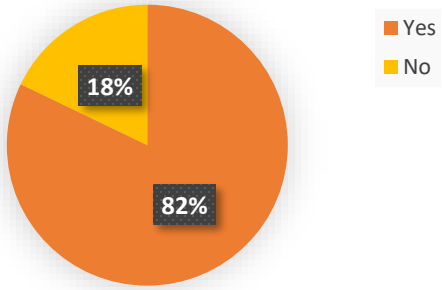


Fig. 3. Have you been trained in nuclear and radiation safety issues?

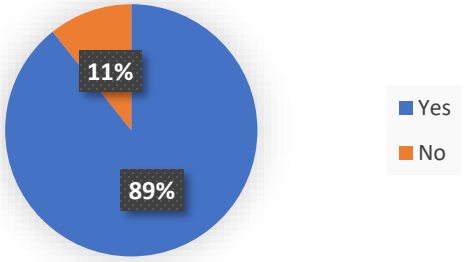


Fig. 3.1 If yes, does the knowledge gained from the training help you manage your, other staff and patient safety, as well as to inform the patient (e.g. about radiation risk / benefit, patient consent…

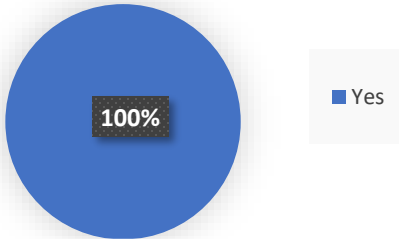
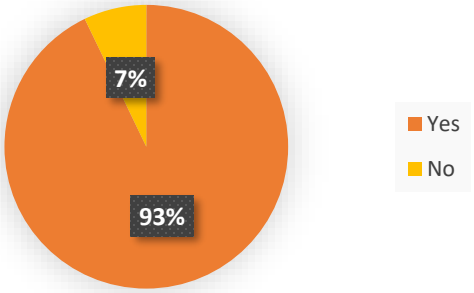


Fig. 4. Are you aware of the national legislative requirements in the field of radiation safety?



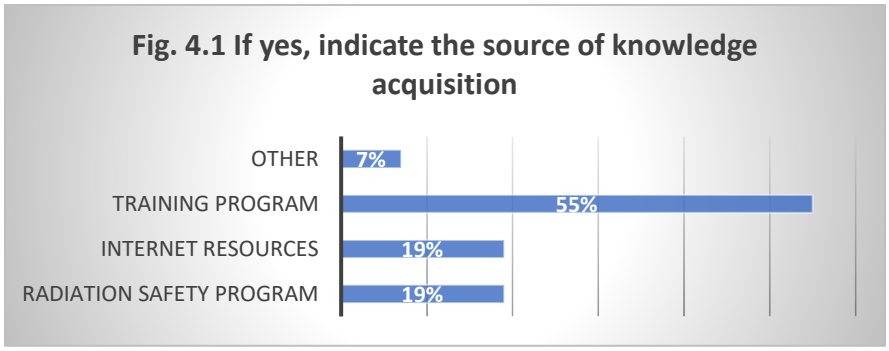


Fig. 4.1 If yes, indicate the source of knowledge acquisition
OTHER
TRAINING PROGRAM
INTERNET RESOURCES
RADIATION SAFETY PROGRAM
7%
55%
19%
19%

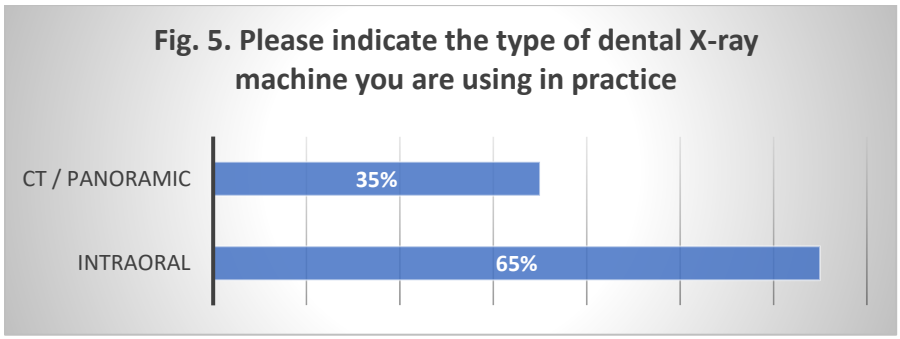


Fig. 5. Please indicate the type of dental X-ray machine you are using in practice
CT / PANORAMIC
INTRAORAL
35%
65%

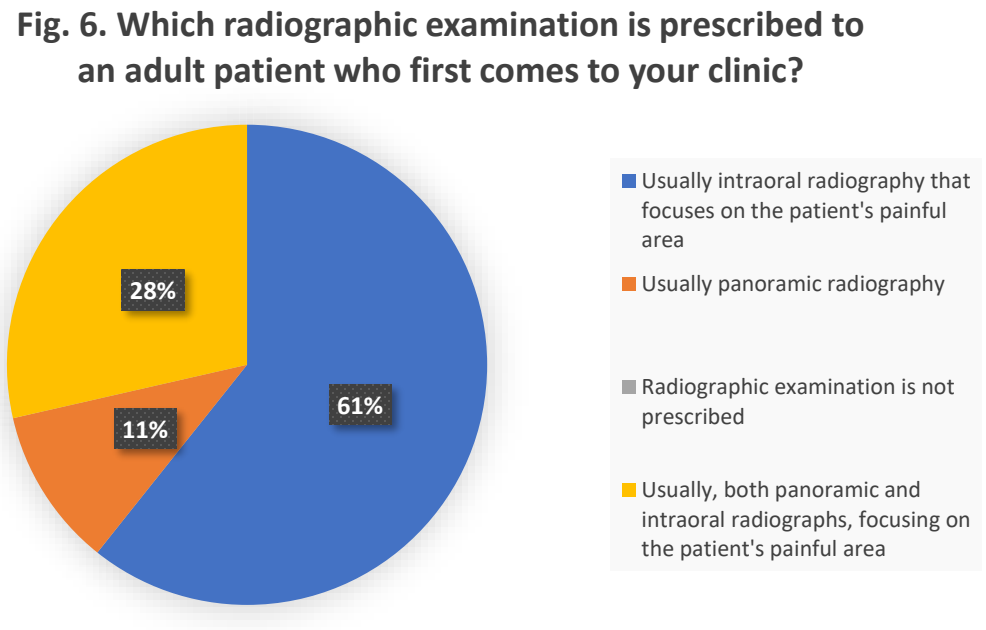


Fig. 6. Which radiographic examination is prescribed to an adult patient who first comes to your clinic?
28%
11%
61%
Usually intraoral radiography that focuses on the patient's painful area
Usually panoramic radiography
Radiographic examination is not prescribed
Usually, both panoramic and intraoral radiographs, focusing on the patient's painful area

Fig. 7. Which radiographic examination is prescribed to a paediatric patient who first comes to your clinic?

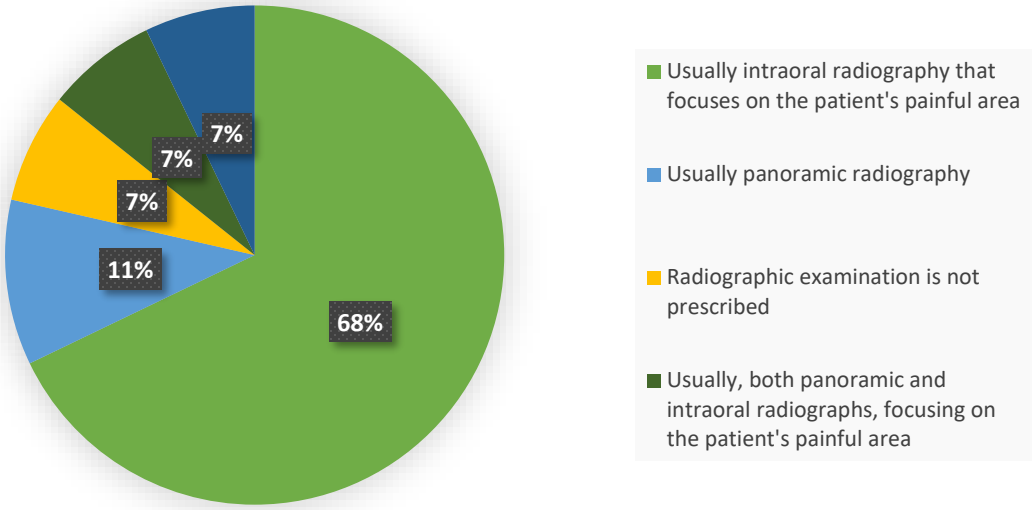


Fig. 8. Do you use the patient's radiation protection facilities (e.g. lead apron, thyroid collar)?

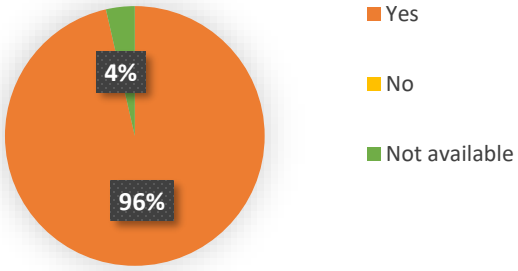


Fig. 9. Do you use an individual personnel dosimeter?

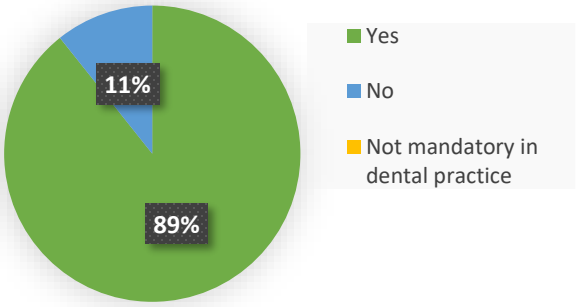


Fig. 9.1 If yes, do you know the annual effective dose taken by you?

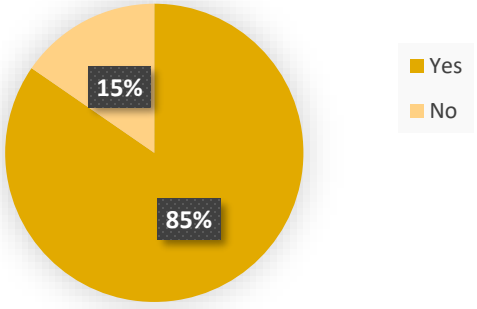


Fig. 9.1.1 If yes, how long have you been conducting individual monitoring?

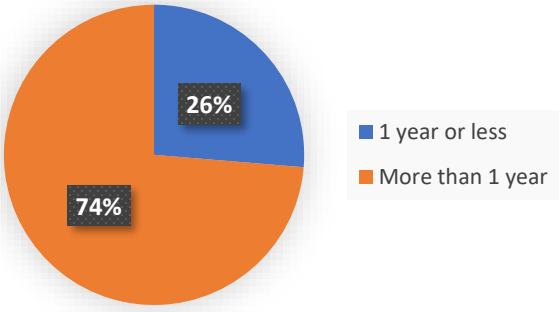


Fig. 10. From what distance is the image taken by the operator?

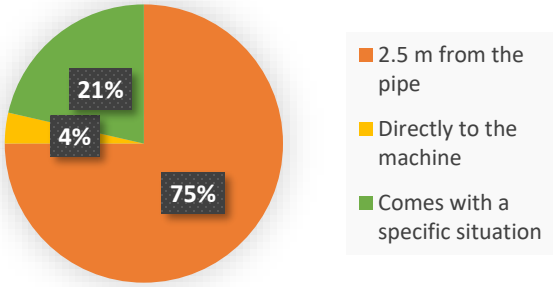


Fig. 11. Are you aware about the liquidation plan of the radiation incident, accidental radiation prevention and possible consequences?

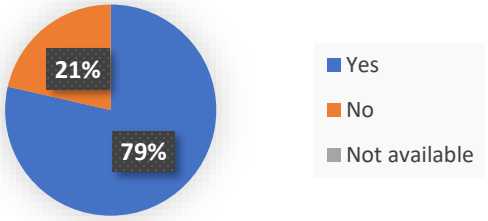


Fig. 12. Does the damage accompany the dental radiographic examination?

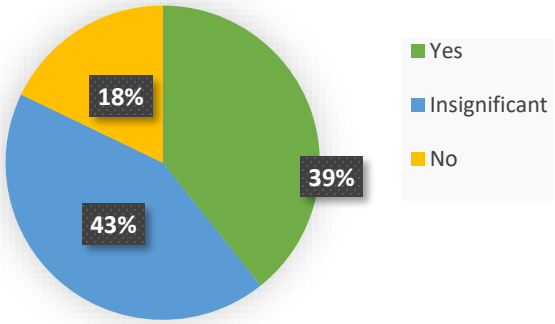


Fig. 13. Are X-rays reflected from the walls of the room during dental radiography?

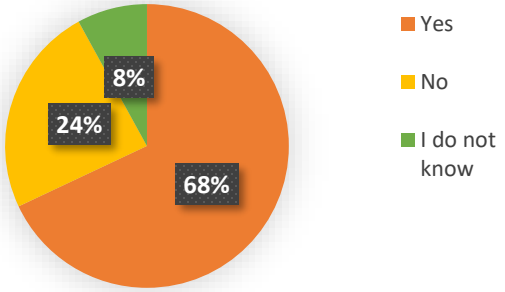


Fig. 14. Do you have information about the use of collimators and filters in dental radiography?

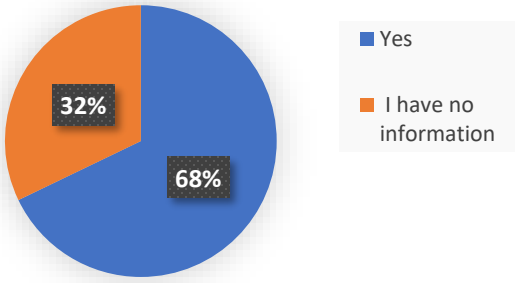


Fig. 15. Have you heard about deterministic and stochastic effects?

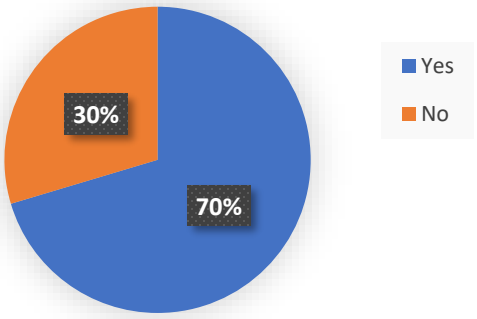


Fig. 16. Do you know the ALARA principle?

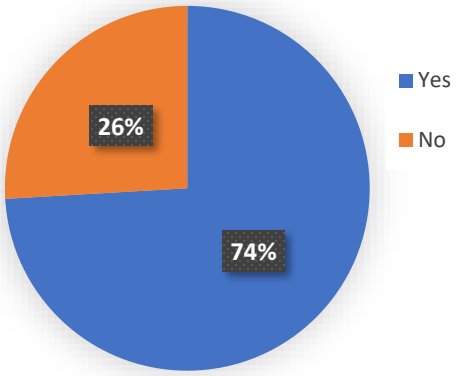
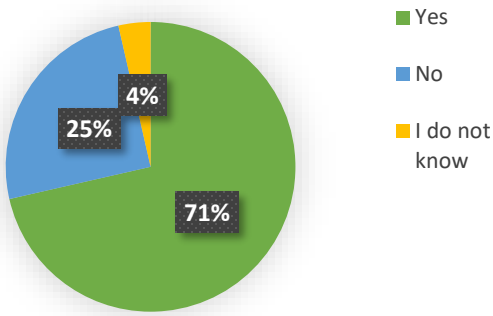


Fig. 17. Has contraindication a dental radiography examination in pregnant patients?



This study demonstrated that the majority of dentists in Georgia (75%) who took part in our survey have work experience from 1 to 5 years (Fig 1.) and 82% of them have the relevant qualifications of a radiologist (Fig 2.) and all of them 100% been trained in nuclear and radiation safety issues (Fig.3.). Regarding the attitude towards of the national legislative requirements in the field of radiation safety 82% of respondents answered yes (Fig 4.), but they named various source of knowledge acquisition (Fig 4.1), where training is defined by more than half of the respondents (55%). With regard to X-ray machines, 65% of respondents use intraoral and only 35% use CT or Panoramic type of X-machines (Fig 5.). In pediatric procedures, 68% usually use, both panoramic and intraoral radiographs, focusing on the patient's painful area (Fig 7), in case of adult patient 61% of the dentists usually use intraoral radiography that focuses on the patient's painful area (Fig 6). The responders 96% use radiation protection facilities of the patients (Fig 8), 89% of the dental specialists use individual personnel dosimeter (Fig 9), 85% of them were aware about their annual effective dose (Fig 9.1) and they were conducting individual monitoring more than 1 year (74%) (Fig 9.1.1.)

75% answered that the image is taken by operator 2.5m from the pipe (Fig 10) and 79% of them were aware about the liquidation plan of the radiation incident, accidental radiation prevention and possible consequences (Fig 11). The responders 43% think that dental radiographic examination accompany insignificant damage (Fig 12), 68 % realize that X-rays could be reflected from the walls of the room during dental radiography (Fig 13) and as well 68% had information about collimators and filters use in dental radiography (Fig 14). 70 % showed that they were aware about deterministic and stochastic effects (Fig 15). The dentists 74 % were aware about ALARA principle (Fig 16) and 71% indicated that dental radiography examination has contraindication in pregnant patients (Fig 17).

Discussion: Although regulatory requirements are in place for dental radiological facilities and activities, and the results of this questionnaire are satisfactory, they will be taken into account when revising the requirements.96% of respondents use personal protective equipment and 89% use individual personnel dosimeters. This indicates that their awareness is high enough. It is noteworthy that those who do not use protective equipment or personal dosimeters, there is an opinion that their clinics have not yet purchased because for example it is newly opened (the number of clinics is increasing).

Relatively little knowledge of ALARA, as well as the emergency plan indicates the need to strengthen of trainings in radiation safety and protection. Strengthen the relationship between the relevant stakeholders is also very important.

Conclusions: This article is the first study in Georgia conducted jointly by a scientific organization, a national regulatory authority, as well as educational and professional structures. The analysis of the results of the presented questionnaire, on the one hand, allows the assessment of mandatory knowledge of radiation protection and safety issues of the target personnel. On the other hand, such feedback based on statistical data is a prerequisite for the revision of possible further regulatory requirements. Staff awareness issues involve the involvement of the relevant professional associations, which will allow it to strengthen the requirements for its members in the long run, as well as better analyze existing practices. According to the questionnaire, the majority of specialists have the appropriate qualifications, and since more than half of them subsequently receive information during trainings, the permanent improvement of the quality of trainings and retraining of the trainers themselves can be regarded as one of the important tasks that makes it possible to enhance radiation safety in the field of dentistry in Georgia. In general, attitudes of staff involved in dental radiological procedures in Georgia towards radiation protection and safety In general, can be considered almost satisfactory, but modern requirements of radioprotection and safety is a systemic problem and requires a system solution which includes close interaction of the relevant stakeholders: a scientific organization, a national regulatory authority, as well as educational and professional structures.

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References:

1. UNSCEAR 2008 Report; “Sources and effects of ionizing radiation” Available at: http://www.unscear.org/. Accessed March. 20, 2015.
2. ICRP. Recommendations of the ICRP. ICRP Publication 26. Ann ICRP 1977;
3. ICRP, 2007. The 2007 Recommendations of the International Commission on Radiological Protection. ICRP Publication 103. Ann. ICRP 37 (2-4). Available at: http://www.unscear.org/
4. ICRP, 2007. Radiological Protection in Medicine. ICRP Publication 105. Ann. ICRP 37 (6). Available at: http://www.unscear.org/
5. American Dental Association Council on Scientific Affairs. The use of dental radiographs: update and recommendations. J Am Dent Assoc 2006; 137: 1304–12.
6. American Dental Association. Dental radiographic examinations: recommendations for patient selection and limiting radiation exposure. 2012. Available from: http://www.fda.gov/downloads/ Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/MedicalImaging/MedicalX-Rays/UCM329746.pdf [cited 2016 Aug 9]
7. European Commission (EC). Radiation Protection 136. In: European guidelines on radiation protection in dental radiology. Luxembourg; 2004.

8. National Council on Radiation Protection and Measurements (NCRP). Report No: 172. In: Reference levels and achievable doses in medical and dental imaging: recommendations for the United States; 2012.
9. National Conuncil on Radiation Protection and Measurements (NCRP). Report No: 145. In: radiation protection in dentistry. Bethesda: National Council on Radiation Protection and Measurement; 2003
10. F Todua, D Nadareishvili, G Ormotsadze, T Sanikidze. Basic Radiation Protection Education and Training for Medical Professionals; Georgian Experience and Future Perspective. Radiat Prot Dosimetry. 2016 Jun;169(1-4):422-4. doi: 10.1093/rpd/ncv528.
11. Z.Alkhanishvili, K.Gogilashvili, G.Tabaghua, L.Kvatsashvili Dental Radiography Principles and Radiation Protection in Dentistry Tbilisi,Georgia 2018 ISBN 978-9941-8-0480-9
12. Turn Your Clinic into a Brand - Dental Office Management. Alkhanishvili Z, Gogilashvili K,Tabaghua G, Gvasalia N, Chikovani A, Osepashvili T, Andriadze N, 2020 – ISBN: 978-994 1-8-1632-1.
13. Aps JK. Flemish general dental practitioners' knowledge of dental radiology. Dentomaxillofac Radiol 2010; 39: 113–8. doi: https://doi.org/10.1259/dmfr/52763613
14. Hunjin Oh HO, Lee G, Lee C, Lee B, Jeong S, Kim B. The safe use of dental X-ray. 2015. Available from: http://www.imagegreen. org/info2/images/xx.pdf [cited 2016 August 16]
15. Rehani MM, Gupta R, Bartling S, Sharp GC, Pauwels R, Berris T, et al. Radiological protection in cone beam computed tomography (CBCT). ICRP publication 129. Ann ICRP 2015; 44: 9–127. doi: https://doi.org/10.1177/0146645315575485
16. HJ R. Trends in dental radiography equipment and patient dose in the UK and Republic of Ireland. 2013. Available from: https://www. phe-protectionservices.org.uk/cms/assets/gfx/content/resource_ 3320cs36ed197b3f.pdf [cited 2017 May 23]
17. Dölekoglu S, Fisekcioglu E, İlguy M, İlguy D. The usage of digital radiography and cone beam computed tomography among Turkish dentists. Dentomaxillofac Radiol 2011; 40: 379–84. doi: https://doi.org/10.1259/dmfr/27837552
18. Looe HK, Pfaffenberger A, Chofor N, Eenboom F, Sering M, Rühmann A, et al. Radiation exposure to children in intraoral dental radiology. Radiat. Prot. Dosimetry 2006; 121: 461–5. doi: https://doi.org/10.1093/rpd/ncl071
19. Hoogeveen RC, Hazenoot B, Sanderink GC, Berkhout WE. The value of thyroid shielding in intraoral radiography. Dentomaxillofac Radiol 2016; 45: 20150407. doi: https://doi.org/10.1259/dmfr.20150407
20. Kim YJ, Cha ES, Lee WJ. Occupational radiation procedures and doses in South Korean dentists. Community Dent Oral Epidemiol 2016; 44: 476–84. doi: https://doi.org/10.1111/cdoe.12237
21. 6. White SG, Pharoah MJ. Oral radiology: principles and interpretation. Mosby, St. Louis, USA;2004:25−46
22. . Kantor ML. Longitudinal trends in the use of individualized radiographic examinations at dental schools in the United States and Canada. J Dent Educ. 2006;70(2)
23. Prabhat MPV, Sudhakar S, Kumar BP, et al. Knowledge, attitude and perception (KAP) of dental undergraduates and interns on radiographic protection- A questionnaire based cross-sectional study. Journal of Advanced Oral Research. 2011;2(3).
24. R Jacobs et al. Attitude of the Belgian dentist population towards radiation protection. Dentomaxillofacial Radiology. 2004; 33: 334–339.