

Status of Individual Dosimetry for Dentists in Lithuania in year 1996-2001

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SUMMARY

Occupational exposure to radiation for dentists can occur as result of work with dental X-ray equipment. Since 1995 a part of dentists started to work with dental X-ray equipment in Lithuania. Individual dosimetry is performed in order to control occupational exposure and it shows the number of dentists working with dental X-ray equipment. The aim of study was to analyze number of dentists working with dental X-ray equipment and status of individual dosimetry for dentists in Lithuania in 1996 - 2001.

The ratio dentists working with dental X-ray equipment from all dentists was found. The measurements of doses for dentists were performed in Subdivision of Individual Dosimetry of Radiation Protection Centre in Vilnius, Lithuania. The "Rados" thermoluminescent dosimetry system (Finland) was used. Each dentist who was working with dental X-ray equipment got an individual dosimeter with personal number. The dose measurement period was once in three months. The operational dose quantities used for external exposure were the personal dose equivalent Hp (10), where minimum registered dose was 0.01mSv. Detailed analysis of individual doses received by dentists was performed.

The number of dentists working with dental X-ray equipment increased from 68 to 237 since 1996 to 2001. The ratio of dentists working with X-ray equipment from all dentists increased from 3.98 % to 9.07 %. A majority of dentists did not receive occupational annual recording level (1.00 mSv). The highest individual occupational annual dose for dentist was 2.7 mSv. The highest average occupational annual dose for dentists was 1.16 in 1997 and the lowest was 0.74 mSv in 1996.

In conclusion, there is small number of dentists working with dental X-ray equipment and it increased slowly in Lithuania. The annual effective doses of dentists in Lithuania in 1996 to 2001 are not exceeding approved dose limits for radiation workers.

Key words: exposure, individual dosimetry, thermoluminescent dosimeter, dentist

INTRODUCTION

Occupational exposure to radiation for dentists occurs from scattered radiation from patient and leakage from tube head of dental X-ray equipment, although latter should be insignificant with modern equipment. Individual monitoring is recommended or required for medical personnel working with X-ray by international documents (1, 2). According to the legislation in Lithuania, workers whose annual doses are likely to exceed 6 mSv, should be monitored (3, 4). In general occupational exposure is directly proportional to the workload. The other relevant factor for occupational exposure doses is the education and training of personnel. Some dentists after postgraduate education abroad started to perform intraoral dental examination by themselves since 1995. Undergraduate education in Oral Radiology in dentistry in Lithuania was a part of General Radiology course and work with dental X-ray equipment was not included in study program until 2000. The course of Oral Radiology was introduced in 2001. Graduates of Vilnius University are able to perform intraoral radiographic examination with dental X-ray equipment by themselves. Dentists, who would like to start to work with dental X-ray equipment, since 1996 have had to do the professional course "Practical work with dental X-ray equipment". This course consists 35 hours. The additional special course of "Radiation protection" of 30 hours is obliga-

tory since 1999 and should be confirmed every five year (5, 6). In order to control occupational exposure of dentist individual dosimetry is performed (7). In accordance with data allows estimating the number of dentists working with dental X-ray equipment in Lithuania. The aim of the study was to survey the number of dentists working with dental X-ray equipment and to analyze status of individual dosimetry for dentists in Lithuania in 1996 to 2001.

MATERIAL AND METHODS

The number of dentists in Lithuania was taken from 1996 to 2001 from Health Information Center of Lithuania and from National Service of Accreditation for Health Care Activity at the Ministry of Health of the Republic of Lithuania. The measurement of individual doses of dentists was performed in Subdivision of Individual Dosimetry of Radiation Protection Centre in Vilnius, Lithuania. Thermoluminescent dosimetry system "Rados" (Finland) was used. System "Rados" consists of thermoluminescent irradiator used for each day calibration, thermoluminescent dosimeter (TLD) reader connected with computer (TLD Magic program) and individual thermoluminescent dosimeters with two LiF pellet covered within a 1 mm Al filter in a standard holder.

Dentists working with dental X-ray equipment wore individual thermoluminescent dosimeter with personal number in front of body in level of breast during working day. Dose monitoring period was each three-month.

The dose measurement procedure. LiF pellet from individual dosimeter was heated in nitrogen flow and thermoluminescent light emission was measured. In order to

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Table 1. Total number of dentists and dentists working with dental X-ray equipment in Lithuania in 1996 to 2001

	Year 1996	Year 1997	Year 1998	Year 1999	Year 2000	Year 2001
Total number of dentists	1709	2153	2259	2306	2446	2613
Number of dentists working with dental X-ray equipment	68	105	156	190	198	237

produce dose values in real dose units the row count data was corrected for factors: background, Reader sensitivity, individual pellet and dosimetric calibration. Received personal dose equivalent Hp (10) in mSv was treated as effective dose of external exposure. The minimum registered dose was 0.01 mSv. For three-month period recording level 0.25 mSv and the annual recording level 1.00 mSv was accepted.

The ratio of dentists working with dental X-ray equipment from all dentists was made. Detailed analysis of doses received by dentists was performed.

RESULTS

Total number of dentists and number dentists working with dental X-ray equipment in Lithuania in 1996 to 2001 is presented in Table 1. The obtained data shows that the number of dentists working with X-ray equipment increased from 68 in 1996 to 237 in 2001 progressively. Percentage of dentists working with dental X-ray equipment from all dentists increased from 3.98 % to 9.07 % during the period from 1996 to 2001, despite of less percent in 2000, then 1999 as shown in Figure 1.

The data of average occupational annual doses for

dentists in Lithuania in 1996 to 2001 is shown in Figure 2. The highest average annual dose was 1.16 in 1997 and the lowest 0.74 mSv in 1996. Since 1999 the average occupational annual doses were close to 0.8 mSv.

Distribution of dentist by occupational annual dose intervals in 1996 to 2001 in Lithuania is shown in Figure 3, where 68 % of dentists did not receive 1.00 mSv. Measured annual doses for larges part of dentists were in the interval of 0.5 – 0.99 mSv. In total, it contained 47 % of dentists. For 67% and 56% of dentists the measured doses were lower than in 1997 and 1998, respectively. Since 1999 occupational annual doses more then 1.00 mSv were measured for 21% dentist. The highest occupational annual individual dose for dentist was 2.7 mSv in 1998.

DISCUSSION

In our study, the number of dentists working with dental X-ray was 237 of total 2613 number of dentists in 2001. This small amount of dentists is possible, because not in all working places of public health institution dental X-ray equipment is installed. Dentists send patients to departments of general radiology for intraoral examination. The

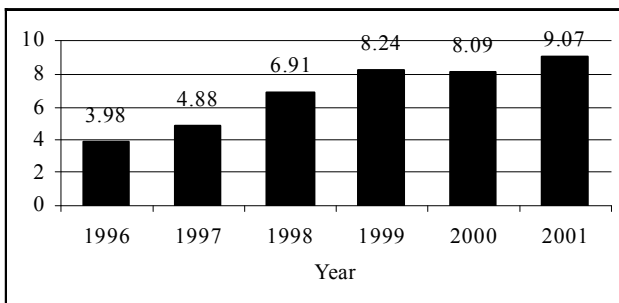


Figure 1. Percentage of dentists working with dental X-ray equipment from all dentists in Lithuania in 1996 – 2001.

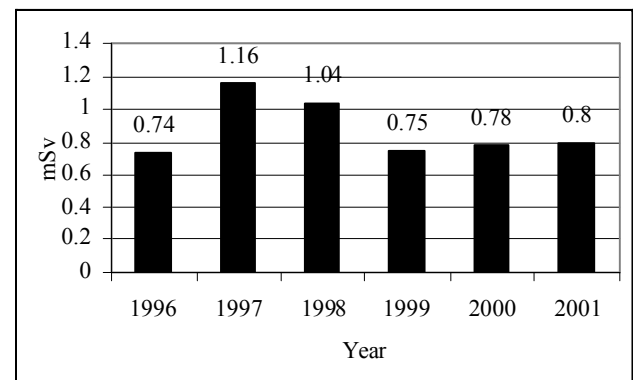


Figure 2. Average of individual annual dose (mSv) for dentists in Lithuania in 1996 to 2001.

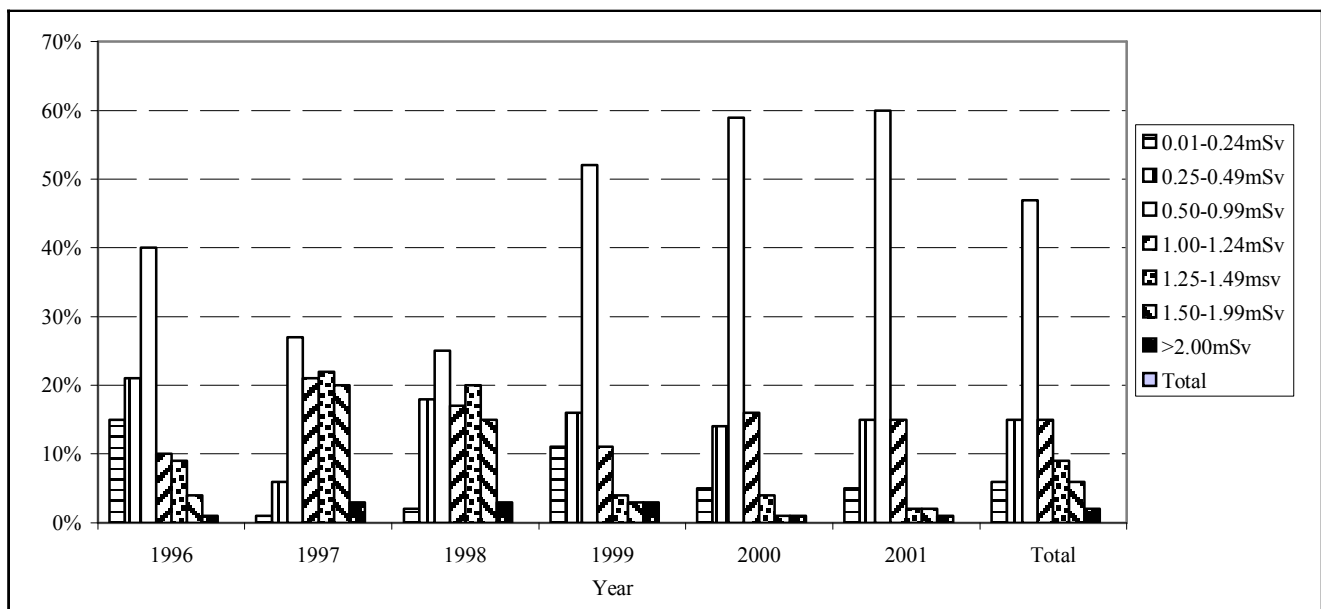


Figure 3. Distribution of dentists expressed by percentage by occupational annual dose intervals in Lithuania in 1996 to 2001.

part of dentists working in private practice has contract with the Department of General Radiology or with colleague for intraoral examination. The second reason for a small number of dentists working with X-ray is dental assistants who have permission to perform intraoral examination, so dentists have no necessity to work with dental X-ray equipment. The international and national legislation prescribes the special cases then routine individual monitoring for dentists is not necessary. Therefore the number of monitored dentists is not necessary shows accurate number of dentists working with X-ray equipment.

Approved doses limit in Lithuania is an effective dose of 20 mSv per year averaged over five consecutive years. In Lithuania average annual doses of dentists in year 2002 were similar to 1999-2001 – 0.8 mSv (8). In 1997 and 1998 average annual doses of dentists overcome 1.00 mSv. The decrease of average annual doses could be connected with the derivation of background exposure level and its extraction from measured doses, which was started in the middle of 1998.

In comparison of other radiation workers dentists received smaller doses. For example annual doses of dental

assistants in 1997 were 1.12 mSv and in 1998 they were 1.00 mSv, annual doses of X-ray nurses were 1.42 mSv and 1.49 mSv, respectively and annual doses of X-ray radiologist were 1.60 mSv and 1.56 mSv, respectively (9). The average annual doses of medical workers in 2001 were 1.16 mSv and in 2002 were 1.14 mSv in Lithuania. During period from 1996 to 2001 32 % of dentists received annual doses higher than 1.00 mSv. However, the doses were not high. The measured highest occupational annual individual dose for a dentist was 2.7 mSv. High doses in dentistry are not unknown. However, it is probable that the recorded dose reflect not the actual exposure, but the fact that individual dosimeter is sometimes left in the areas where it could be irradiated.

CONCLUSION

The number of dentists working with dental X-ray equipment increased slowly. The annual effective doses of dentists are not exceeding approved dose limits in Lithuania in 1996 to 2001, but personal dosimetry should be performed in some period in order to ensure appropriate radiation protection level of dentists.

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