A Questionnaire Study on Patient Knowledge on X-ray Radiation Effects on Human Health from Dental Radiographic Examination

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ABSTRACT

Swedish Radiation Safety Authority has suggested guide-lines regarding information to individuals who undergo radiographic examinations. The guide-lines concerns medical care but patients in dental care can also be expected to have a wish to be informed about ionizing radiation.

The main objective was to find out the patient’s perception of their knowledge about x-ray radiation and if they have a need to know more about x-rays.

A questionnaire study was performed at two public dental clinics in Sweden during a two-month period in the summer 2016. Patients ≥ 18 years old who gave their consent to participate were included in the study.

Of all 429 participants 44 % declared an average knowledge about x-ray radiation and 37 % of all participants declared an inadequate knowledge. A total of 54 % had been informed about x-ray and its effects. School was the most common information source. Approximately 76 % had the perception that dental x-ray radiation is not harmful. 51 % declared the need to know more about x-ray. Approximately 52 % declared no knowledge about natural background radiation and 59 % declared it valuable to know more about dental x-ray in relation to natural background radiation.

The participants showed mixed opinion and perception about x-ray radiation. A majority of patients want to know more about x-ray radiation. The study did not identify any particular group(s) needing more information about x-ray radiation than what is included in the justification of the radiographic examination.
INTRODUCTION

History

X-ray radiation was first discovered on November 8, 1895 by the German physicist Wilhelm Conrad Roentgen, who was working with a vacuum tube called ‘Hittorf- Crookes tube’. He did not know what was traveling through the room he worked in and named it X-rays. Roentgen was awarded with the Nobel Prize 1901 for his discovery. In early spring the same year, the first intraoral radiograph was taken in the USA by Dr. C. Edmond Kell. The year 1896 the American scientist and dentist, William Rollins was first to construct a dental x-ray machine. Rollins and his colleagues also reported side effects of x-rays. Rollins got burn injuries on his hands and recommended protection of both the tube and the patient. These side effects of x-rays set the stage that protection was needed to avoid injuries (Frommer and Stabulas-Savage, 2011).

Ionizing electromagnetic radiation

X-ray radiation is defined as ionizing electromagnetic radiation, comprising invisible waves of photon energy. This type of radiation can interact with matter resulting in absorption of energy and thus a reduction of intensity of the x-ray radiation. The energy absorbed by the living tissue can cause biological changes and therefore tissue damage. The changes are caused by ions and free radicals created as a result of ionization (Frommer and Stabulas-Savage, 2011).

Radiation doses

The unit Joule (J) stands for energy absorbed e.g. in the body after medical x-ray examinations. Radiation dose is expressed in the unit Sievert (Sv) defined as 1 joule of absorbed energy per kilogram of tissue. The dose depends on the type of radiographic examination performed. Examinations of teeth, arms, lungs and mammography provides a relative low radiation dose, while examinations of the stomach, lower back, colon, and computed tomography of the cranium induce relatively higher radiation doses (ICRP, 2001). Depending on radiation dose, different injuries can occur denoted acute injuries and late injuries. Acute injuries that may occur in connection with large exposures, give symptoms like skin redness, sterility, damage to eyes, nausea, and weakened immune system. A radiation dose of 1000-2000 mSv, received in a short time, gives acute injuries. Cancer and hereditary defects are examples of late injuries. In the case of late injuries, the probability of,
for example, incurable cancer is very low but does, even in very small doses, from a statistical point of view never reach zero (The Swedish Radiation Safety Authority, 2001).

**Radiation dose reduction**

In dental practice patients are exposed to radiation and various ways to minimize the doses have been developed:

1. The distance between the individual and a radiation source determines the radiation exposure. The further away the radiation source is to the individual, the lower the radiation exposure (applicable to the staff).
2. Shielding material can be used to absorb radiation energy. In dental praxis for example, lead apron are used to absorb secondary radiation to prevent it from reaching tissues outside region of interest (Thaul and O’Maonaigh, 1999).
3. A digital system gives approximately a half of the given dose compared to previous used analog systems.
4. Changing the shape of the primary beam from 5 centimeters in diameter to a square 3x4 centimeter at the end of the aiming device can reduce the dose by 40%.
5. Increasing the length of the aiming device from 20 centimeters to 30 centimeters can reduce the dose by 10%.
6. Changing to an x-ray device with 70 or 75 kVp and cascade generator, gives an even direct-current voltage generating lower doses compared to older x-ray machines generating radiation in pulses (Gröndahl, 2008).

**Natural background radiation**

Ionizing radiation exists in our environment and is called natural background radiation. This radiation originates from various sources in nature. Today medical exposure and other man made sources is included in natural background radiation due to its relatively extended use and because they for a long time will be irrevocable integrated in society. Table 1 shows examples of different radiation sources and calculated doses emanating from them (Oskarshamn kärnkraftverk, 2017).

**Patient dosage**

Based on table 1, a 70-kg person absorbs approximately 196 mJ during a year from the environment. The body absorbs approximately 0.2 mJ after a dental x-ray exposure, which is equivalent to a radiation dose of approximately 0.004 mSv. Exposure of a panoramic image
gives approximately a radiation dose of 0.02 mSv. A full mouth series (20 images) correspond approximately a radiation dose of 0.08 mSv (Gröndahl, 2008).

The mean effective dose from natural background radiation is about 2.4 mSv per year in average on a global level (Canadian Nuclear Safety Commission, 2013).

**Measuring radiation**

Radiation dose can be presented in different ways and with different units depending on what is being measured, for example absorbed dose, radioactivity or exposure (U.S.NRC 2014).

**Effective dose** is expressed in Sievert (Sv). Is defined as the sum of equivalent doses weighted for different organ's radiation sensitivity (WT).

**Absorbed dose** is expressed in gray (Gy). Is defined as radiation energy absorbed per mass unit (J/Kg).

**Equivalent dose** is expressed in Sievert (Sv). Is defined as absorbed dose weighted for the relative biological effect of different types of radiation e.g. particulate radiation, electromagnetic radiation. The weighting factor describes the relationship between the amount of absorbed dose and the biological effects induced by the different types of radiation.

**Exposure** is expressed in the unit Roentgen (R) and is defined as the amount of radiation that the patient is exposed to in an area (Frommer and Stabulas-Savage, 2011). Thus, it is the number of ions created when radiation travels through air in connection with exposure. The exposure can be various types of radiation (U.S.NRC, 2014).

**Ionizing radiation; risk assessment in the society**

Many incidents have involved more dangerous forms of radiation including particular radiation such as in the Tjernobyl nuclear reaction accident and the nuclear bombing in Hiroshima and Nagasaki during World War II (Swedish Radiation Safety Authority, 2011). Such events, may lead to patients avoiding radiographic examinations e.g. at dental visits, even though ionizing radiation used in most diagnostic situations, induces relative low doses (Frommer and Stabulas-Savage, 2011).

A study made in Lublin in Poland described that there are demographic differences in the polish society regarding the perception of x-ray radiation based on gender, education, age and
location. What the differences were and what the reasons were, was, however, not described (Kalinowski et al., 2011).

**The Swedish Radiation Safety Authority**

The Swedish Radiation Safety Authority is a government administrative authority. It establishes regulations regarding radiation protection and nuclear safety in society. The task of Swedish Radiation Safety Authority is to protect human health and the environment from harmful effects of ionizing radiation.

The Authority has suggested that information about potential benefits and risks from medical x-ray examinations should include the following:

1. The patient, or persons accompanying the patient, should receive the same information and instructions on appropriate measures and precautions taken in order to minimize the radiation dose
2. Pregnant women who will undergo medical exposure should be informed about the risks which are associated with exposure and even should be recommended using Lead apron before the exposure begins.
3. Clinicians who have taken a decision on medical exposures to identify diseases at an early stage in people without symptoms shall inform the person subjected to exposure of the particular circumstances of the decision.

This suggestion applies only to medical examinations. Dental patients also have the right to be informed about radiation doses and the justification for its use. To be able to convey adequate knowledge in a good way, it is important to know the level of knowledge the patients have about ionizing radiation and their expectations regarding information within the subject (Swedish Radiation Safety Authority, 2016).

**AIM**

The aim of this study was to find out patient’s opinion about their overall understanding and knowledge about X-ray radiation. Furthermore, to find out if patients have been informed about X-ray radiation and its effects and if so, under what circumstances. We also wanted to find out to what extent the patients regard X-ray radiation within dentistry dangerous and if so, to quantify it and to find out if patients are interested in receiving more information about x-ray radiation and to what extent they are aware of the so called background radiation. Based on the data we wanted to see if there are any differences in the patient’s apprehension of ionizing radiation depending on age, gender, profession and/or education.
MATERIALS & METHODS

Background information was gathered by a literature review of textbooks, PubMed search and internet research. Inclusion criteria were; Radiation safety on patient, natural background radiation, units for ionizing radiation, radiation doses and guide-lines for radiation safety.

Study design

A descriptive questionnaire study was performed. Since the purpose was to see if there were any differences between the studied parameters, a quantitative study design was chosen.

In accordance with Att fråga, Om frågekonstruktion vid intervju- och enkät-undersökningar, Statistiska centralbyrån (Langlet and Wärneryd, 1980) the survey questions were prepared and designed. In total ten questions (five open) and sub questions for personal reflections were constructed. Some of the questions were designed as statements for the patients to consider (see attachment 1).

Question 1-4 addressed the patient demographics. Question 5-10, addressing patient's perception of x-rays, were answered by marking "Yes" or "No" (3 questions) or to grade their opinion on a six-graded scale (3 questions).

Ethical considerations

Participation in the study was voluntary and the participants answered the questionnaire anonymously. The participants were informed about the study's purpose and its content. They were also informed that the results would be presented on group level. Before they received the questionnaire, they gave their consent verbally. The patients that chose not to participate in the study did not fill in any paper. The Ethics Forum at the Department of Odontology found that appropriate ethics considerations had been integrated into this degree project.

Data Collection Method

The study was performed at two public dental clinics in Sweden, one in Umeå, and one in Vimmerby. Data collection took place between 2016-06-07 and 2016-08-07. Individuals who were eighteen years or older were asked to participate in the study.
Statistical analysis

The compilation of the received data/answers from the questionnaire study were coded and entered into Statistical Package for Social Sciences (SPSS) version 23 software and analyzed using the Descriptive and Explore sections.

To analyze possible differences between different groups i.e. gender, age, education and profession, Mann-Whitney, Chi-square, One-way ANOVA and Kruskal-Wallis test were used in SPSS. The level of significance was set to 0.05.

RESULTS

Totally 447 individuals answered the questionnaire. A total of 18 questionnaires were excluded because of incomplete answers on question 5 - 10 resulting in a total of 429 participants. The participants were divided into sub groups. ‘Age’ was divided into 18-39 years and ≥ 40 years. ‘Education’ was divided into high school without further education and high school with further education. The number of individuals within different groups is summarized in Table 2. Because of a large variety of professions, this parameter could not be divided into subgroups with reasonable sizes. Therefore, statistical analysis with respect to differences in profession was not performed

The participant’s overall knowledge about x-ray radiation was by 59 % of all participants declared as “low knowledge” (1 to 3 on a scale 1-6 representing ‘inadequate’ to ‘very good’). The remaining 41 % of the participants had an overweight towards ‘good knowledge or very good knowledge’ (4 to 6) see Table 3, item 5.

A slight majority (54 %) had been informed about x-ray radiation and its effect. The most common source of information was schools (52 %) and the second most common source was from medical and dental staff (36 % each). (See table 4, question 6.)

The majority of the participants (76 %) had the perception that x-ray radiation in dental praxis is not harmful (table 4, question 8). Extended answers were given by 169 of these (53 %). The most common extended answers expressed that x-ray radiation is not harmful in low doses or that they did not think x-ray radiation affect our health that much, otherwise it would not be used in health care” (80 out of 169 participants). The remaining participants (24 %), declared the opinion that x-ray in dentistry is harmful, (table 4, question 8). Approximately ¼ of these (27 %) e.g. 6.5 % of all participants presented an opinion leaning towards ‘little harmful’
(1+2). The opinion that x-ray in dentistry is ‘very harmful’ (5+6) was declared by 11 % of these participants e.g. close to 3 % of all participants (table 3, question 8b). Extended answers were given by 72 (71 %) of those who declared the opinion that x-ray in dentistry is harmful (table 4, question 8). The most common extended answer (18 out of 72 participants or 4 % of all participants) expressed that their opinion was based on the fact that \textit{protective measures are performed e.g. Lead Apron or dental staff leaving the treatment room in dental praxis}.

Approximately half of the participants (51 %) declared that they wanted to know more about X-ray radiation effects (question 7, table 4). A total of 53 % of those had not been informed about x-ray radiation.

A slight majority (52 %) declared low or no knowledge about the natural background radiation (question 9, table 4). Approximately 59 % of those declared it valuable to know more about radiation dose from dental x-ray examinations in comparison with the dose emanating from natural background radiation (4+5+6, table 3, question 10).

There were 41 % of the participants who declared it not so valuable to know more about radiation dose from dental x-ray examinations (1+2+3, table 3, question 10).

A majority of the females (56 %) declared they wanted to know more about x-ray radiation compared to the males (45 %) (P = 0.024).

A statistically significant larger proportion among men (83 %) had the perception that x-ray radiation in dental praxis is not harmful compared to among women (69 %) (P = 0.001).

Differences between men and women was also seen on how harmful they perceived X-ray in dentistry is. A total of 100 participants (33 males and 67 females) answered question 8b. A total of 15 males (45 %) perceived x-ray radiation as little harmful (scale 1+2) on a scale 1-6. The same proportion (45 %) perceived x-ray radiation as moderate harmful (3+4). The remaining proportion (10 %), perceived x-ray as very harmful (5+6). The majority of the females (47 i.e. 70 %) perceived x-ray radiation as moderate harmful. A total of 12 females (18 %) had the perception that x-ray is little harmful. A total of 8 females (approximately 12 %) had the perception that x-ray is very harmful (P = 0.012).

Differences regarding overall perceived knowledge about x-ray radiation on a scale 1-6 was seen between the education groups. Approximately 67 % of the participants belonging to the high school without further education group declared a low knowledge (1+2+3). In the high school with further education group corresponding figure was 53 %. (P = 0.004).
A statistically significant larger proportion of the high school with further education group (61 \%) had been informed about x-ray radiation and its effect, compared to the high school without further education group (49 \%) (P = 0.010).

The answers to question nine (Do you have any knowledge about the natural background radiation?) showed a statistically significant difference between the ‘age’, ‘education’ and ‘location’ sub groups respectively. A larger proportion (54 \%) in the age group ≥ 40 years old knew about natural background radiation compared to the age group 18-39 years (42 \%) (P = 0.023). This was also the result for the high school with further education group (60 \%) compared to the high school without further education group (37 \%) (P = 0.000) and for the participants from Umeå (55 \%), compared to the participants from Vimmerby (44 \%) (P = 0.023). Further statistical analysis also showed that a majority of the participants in the ‘high school with further education’ group were from Umeå (58 \%).

DISCUSSION

The majority of participants (59 \%), declared they had low knowledge about X-rays in dental care and 55 \% of those had an interest in knowing more about X-rays and their effects. This is probably because they had not been informed, or that they were just curious to know more. The fact that the majority declared insufficient knowledge also depends on what you as a participant consider to be knowledge within this field. This may have been difficult to interpret for the participants in this study because there was no clear definition of what was meant by “good knowledge” or “lack of knowledge” other than self-perceived.

Approximately half of the participants 52 \% declared knowing nothing about natural background radiation. Information about natural background radiation may not be given in for example media or schools, even though the individuals are exposed for this every day compared to x-ray radiation, which is most likely only encountered in the medical and dental care. Therefore, most individuals may not think about x-ray radiation until they undergo e.g. a dental examination. The individuals who declared they knew about natural background radiation probably had a connection to a profession in health care/ dental care, profession in physics or maybe were just interested in physics. This is not shown in the results, because of difficulty to make statistical analysis based on the answers regarding occupation. Improvement on future questionnaire could include multiple choice regarding areas of profession instead of an open question, to facilitate statistical analysis. As shown in the result, a majority of the participants in the ‘high school with further education group’ were from
Umeå. The result indicate that the difference in knowledge regarding natural background radiation between the two locations can be explained by the difference in the number of participants with different education level among the participants from the two locations.

While most individuals had been informed about x-ray from some source(s), only 20% of all participants had been informed by dental staff. This indicate that informing about x-ray may not be a standard routine in dental care. Among the participants who had not been informed, a majority wished to know more. Because the suggested guide-lines from The Swedish Radiation Safety Authority only apply to medical care, the dental staff does not necessarily always have to inform the patients about risks and benefits with x-ray radiation. This does not, however, mean that dental staff should refrain to inform. According to the results, a majority of the included participants had a lack of knowledge about x-ray and natural background radiation. There were 59% of the participants who wanted to know more about the relationship between doses from dental examinations and from natural background radiation. Therefore, one can conclude that the participants wanted to know more about x-ray in general. Based on this study, a majority of females wanted to know more about x-ray. More females also regarded x-ray radiation harmful compared to males. However, the percentage point difference between males and females was only 11% (45% and 56% respectively) regarding their wish to know more about x-ray. Therefore, the study does not support that e.g. females, and not men, should be informed about x-ray before exposure. To find out if there are any group(s) that is more important to inform, the questionnaire should have been more detailed and, included more participants. Secondly sub question like “Have you ever declined to undergo x-ray examination and why?” could perhaps have identified individuals or groups of individuals that would have benefited from more information about x-ray radiation than others. This question could have been used to see if e.g. there is a correlation between refusal to be radiographically examined and a desire to know more about ionizing radiation.

The study also showed differences related to level of education. These differences were seen regarding knowledge about x-ray radiation, natural background radiation, and if they had been informed about x-ray. A majority in the high school without further education group, had low knowledge about x-ray and natural background radiation and also declared not have been informed. A majority in the high school with further education group declared knowledge about x-ray radiation leaning towards “very good”. A possible reason for this may be that persons who have undergone academic education are more all-round educated. Another reason may be that older people have more experience regarding x-rays in general. According to National agency for Education in Sweden, pupils who undergo class 7-9, will learn
“Physical models to describe and explain the appearance of particle radiation and electromagnetic radiation as well as the effects of radiation on living organisms. How different types of radiation can be used in modern technology, for example in healthcare and information technology” (National agency for Education in Sweden, 2011).

Based on this source, it should be expected that all participants should have been informed about x-ray radiation in school, but according to the study, only 28% of all participants declared they had been informed in school and 46% of all participants declared having not been informed from any sources. Potential reasons for these deviations may be that older curricula could have differed from the present or that schools may consider that medical physics is not important compared to other contents in the curriculum of physics. Another explanation could be that given information not always is remembered by students.

**Conclusion**

Based on the result, we can conclude that there are mixed opinions in both perception and self-evaluated knowledge about x-ray radiation and the doses associated with radiographic examinations. Most people seem to have the opinion that x-ray radiation is not dangerous at the dose levels used in dental radiology. There are indications that most individuals want to know more about the effects from x-ray radiation on human health. The study did not identify any particular group, or groups, that with clinical relevance can be regarded as more urgent to know more about x-ray radiation than others. The dental staff should, however, bear in mind that not all individuals have the same knowledge about x-ray radiation and therefore, if a patient shows any hesitation regarding an x-ray examination, the dental staff should answer any questions the patient might have in order to explain the justification for the radiographic examination.
REFERENCES


### TABLES

**Table 1.** Examples of radiation source and doses on a yearly basis

<table>
<thead>
<tr>
<th>Radiation source</th>
<th>Radiation exposure in millisievert (mSv)/ year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potassium-40/Carbon-14 naturally in human body</td>
<td>0.2 mSv</td>
</tr>
<tr>
<td>Space and sun</td>
<td>0.3 mSv</td>
</tr>
<tr>
<td>Radioactive substances from ground</td>
<td>0.5 mSv</td>
</tr>
<tr>
<td>Medical care</td>
<td>0.6 mSv</td>
</tr>
<tr>
<td>Spill from industry and nuclear power station</td>
<td>&lt;0.1 mSv</td>
</tr>
<tr>
<td>Radon (in doors)</td>
<td>0.8 mSv</td>
</tr>
<tr>
<td>Fallout on the ground and food from contaminated area for example Tjernobyl</td>
<td>0.3 mSv</td>
</tr>
</tbody>
</table>
Table 2. Distribution of participants within different subgroups.

<table>
<thead>
<tr>
<th>Subgroups</th>
<th>Labeling</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>197 (46)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>232 (54)</td>
</tr>
<tr>
<td>Age</td>
<td>18-39 years</td>
<td>214 (50)</td>
</tr>
<tr>
<td></td>
<td>≥40 years</td>
<td>215 (50)</td>
</tr>
<tr>
<td>Education</td>
<td>High school without further education</td>
<td>212 (49)</td>
</tr>
<tr>
<td></td>
<td>High school with further education</td>
<td>217 (51)</td>
</tr>
<tr>
<td>Location</td>
<td>Umeå</td>
<td>184 (43)</td>
</tr>
<tr>
<td></td>
<td>Vimmerby</td>
<td>245 (57)</td>
</tr>
</tbody>
</table>
Table 3. Proportion of participants answering on a scale 1-6, on item 5 and questions, 8b and 10. Note that the result for question 8b is based on the participants that perceive X-ray in dentistry as harmful.

<table>
<thead>
<tr>
<th>Item 5</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>I believe that my current knowledge regarding X-ray radiation and its effect on humans on a scale from 1 to 6 is. (1= inadequate, 6= very good)</td>
<td>14 %</td>
<td>23 %</td>
<td>22 %</td>
<td>22 %</td>
<td>13 %</td>
<td>6 %</td>
<td>425</td>
</tr>
<tr>
<td>Question 8b, What is your perception about how harmful X-ray in dentistry is? (1=little harmful, 6= very harmful)</td>
<td>7 %</td>
<td>20 %</td>
<td>28 %</td>
<td>34 %</td>
<td>9 %</td>
<td>2 %</td>
<td>100</td>
</tr>
<tr>
<td>Question 10 How would you appraise information about the radiation dose from dental X-ray examinations in a comparison with the dose emanating from background radiation? (1= not valuable, 6= very valuable)</td>
<td>10 %</td>
<td>12 %</td>
<td>19 %</td>
<td>22 %</td>
<td>21 %</td>
<td>16 %</td>
<td>403</td>
</tr>
</tbody>
</table>
Table 4. Proportion of participants answering Yes or No to question 6-9

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 6 (<strong>Have you ever been informed of X-ray radiation and its effects?</strong>)</td>
<td>54 %</td>
<td>46 %</td>
<td>426</td>
</tr>
<tr>
<td>Question 7 (<strong>Do you think you have the need to know more about X-ray radiation effects?</strong>)</td>
<td>51 %</td>
<td>49 %</td>
<td>425</td>
</tr>
<tr>
<td>Question 8 (<strong>Do you perceive that X-ray in dentistry is harmful?</strong>)</td>
<td>24 %</td>
<td>76 %</td>
<td>421</td>
</tr>
<tr>
<td>Question 9 (<strong>Do you have any knowledge about the natural background radiation?</strong>)</td>
<td>48 %</td>
<td>52 %</td>
<td>416</td>
</tr>
</tbody>
</table>
Attachment 1

Enkätstudie om patienters uppfattning och kunskap om röntgenstrålning inom tandvården

1. Jag är
   □ Man
   □ Kvinna
   □ Jag föredrar att inte kategorisera mig i ovanstående kategorier

2. Min ålder ligger i intervallet:
   □ 18-29 år  □ 30-39 år  □ 40-49 år  □ 50-59 år  □ 60+

3. Jag har senast genomgått
   □ Grundskola
   □ Gymnasium
   □ Yrkeshögskola
   □ Universitet/höskola

4. Jag arbetar
   som:........................................................................................................................................................................

5. Jag anser att mina kunskaper gällande röntgenstrålning och dess påverkan på oss människor på en skala från 1 till 6 ligger på:

   1  2  3  4  5  6

   Bristfälliga  ○  ○  ○  ○  ○  ○  Mycket goda

6. Har du någon gång blivit informerad om röntgenstrålning och dess effekter
   □ Ja
   □ Nej

   Om du svarar ja ovan; hur/var har du blivit informerad om röntgenstrålning och dess effekter?
   (flera alternativ är möjliga)
   □ I skolan
1. Via massmedia
2. Via sökningar på nätet (Google, Youtube m.m)
3. Information från tandvårdspersonal
4. Information från sjukvårdspersonal
5. På annat sätt,
   Hur?: .................................................................................................................................

7. Tycker du att du har behov av att veta mer om röntgenstrålningens effekter?
   - Ja
   - Nej
   Vad grundar sig ditt svar huvudsakligen på?
   .........................................................................................................................................

   Om du svarat Ja, kan du formulera mer specifikt vad du skulle vilja veta mer om?
   .........................................................................................................................................

8. Är din uppfattning att röntgenstrålning inom tandvården är skadlig?
   - Ja
   - Nej
   Vad grundar sig ditt svar huvudsakligen på?
   .........................................................................................................................................

   Om du svarat ja på föregående fråga,
   På en skala 1-6 vad är din uppfattning om hur skadlig röntgenstrålning inom tandvården är?
   1 2 3 4 5 6
   Lite skadlig ○ ○ ○ ○ ○ ○ Mycket skadlig

9. De stråldoser som röntgenundersökningar ger upphov till hos patienter brukar jämföras med den stråldos man får
   från den så kallade naturliga bakgrundsstrålningen som finns i vår miljö.

   Känner du till den så kallade naturliga bakgrundsstrålningen?
10. Vilket värde skulle du sätta på att få information om hur stor stråldos en röntgenundersökning hos tandläkare/tandhygienist ger patienten jämfört med den dos som bakgrundsstrålningen ger?

1 2 3 4 5 6

Inget värde ○ ○ ○ ○ ○ ○ Mycket värdefullt

Vad grundar sig ditt svar huvudsakligen på?

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**English version**

**Questionnaire Study on patients' understanding and knowledge of X-rays in dental care**

1. I am

☐ Male  
☐ Female  
☐ I prefer not to categorize myself in the above categories

2. My age is in the range:

☐ 18-29 year  ☐ 30-39 year  ☐ 40-49 year  ☐ 50-59 year  ☐ 60+

3. I have lately undergone

☐ Elementary school  
☐ High school  
☐ Vocational university  
☐ University / College

4. I am working as: ........................................................................................................................................................................

5. I believe that my current knowledge regarding X-ray radiation and its effect on humans on a scale from 1 to 6 is:

21
6. Have you ever been informed of X-ray radiation and its effects?
   - [ ] Yes
   - [ ] No
   If you answer yes above; how / where have you been informed of X-ray radiation and its effects?
   (Multiple options are possible)
   - [ ] At school
   - [ ] By the mass media
   - [ ] By searches in the web (Google, Youtube, etc.)
   - [ ] Information from dental professionals
   - [ ] Information from medical staff
   - [ ] In some other way, how?

7. Do you think you have the need to know more about X-ray radiation effects?
   - [ ] Yes
   - [ ] No
   What is your answer mainly based on?

If you answered yes, can you formulate more specifically what you would like to know more about?

8. Do you perceive that X-ray in dentistry is harmful?
   - [ ] Yes
   - [ ] No
   What is your answer mainly based on?

If you answered yes on the previous question, on a scale 1-6, what is your perception about how harmful X-ray in dentistry is?

<table>
<thead>
<tr>
<th>Scale</th>
<th>Little harmful</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>Very harmful</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td></td>
</tr>
</tbody>
</table>
9. The doses of radiation that radiographic examinations cause are usually compared to the dose of radiation you get from the natural background radiation found in our environment.

Do you have any knowledge about the natural background radiation?

☐ Yes
☐ No

10. How would you appraise information about the radiation dose from dental X-ray examinations compared to the dose emanating from background radiation?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not valuable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very valuable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What is your answer mainly based on?

-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------
Appendix

how / where have you been informed of X-ray radiation and its effects?

- School: 52%
- Massmedia: 30%
- Search on the net: 14%
- Medical staff: 36%
- Dental staff: 36%
- Other sources: 12%