

# Patients' Anxiety Related to Dental Radiographic Examinations: Levels, Perception and Management

## Ansiedad de los Pacientes Relacionada con los Exámenes Radiográficos Dentales: Niveles, Percepción y Manejo

Eliana Dantas Costa<sup>1</sup>; Luciano Augusto Cano Martins<sup>1</sup>; Samuel Carvalho Chaves-Junior<sup>2</sup>; Emerson Tavares Sousa<sup>2</sup>; Maria Beatriz Duarte Gavião<sup>2</sup>; Rosana de Fátima Possobon<sup>3</sup> & Matheus Lima Oliveira<sup>1</sup>

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**ABSTRACT:** This study evaluated patients' anxiety levels related to dental radiographic examinations in addition to dentists' perception and management. Salivary alpha-amylase (sAA) activity of 47 patients was measured before and after exposure to radiographic examinations to assess their anxiety level and compared using Wilcoxon test. Mann-Whitney test assessed the sAA activity related to sex, type of examination, and previous experience with radiographic examinations. 50 dentists were interviewed using a semi-structured script containing open-ended questions perception on their patients' anxiety. Before the radiographic examination, sAA activity was significantly higher for women ( $p \leq 0.05$ ). SAA activity significantly increased after the examination for men, patients of both sexes with no previous experience and for those who underwent CBCT ( $p \leq 0.05$ ). Anxiety was reported to be observed in adult patients' speech and pediatric patients' behavior. Dental radiographic examinations may be a source of anxiety for women before the examination. After the examination, men, patients with no previous experience, and those subjected to CBCT present higher anxiety levels. Dentists perceive anxiety in adult and pediatric patients differently.

**KEY WORDS:** anxiety, alpha -amylases, radiology, dentistry, patient care.

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## INTRODUCTION

Anxiety is a physiological response commonly observed in patients undergoing dental treatment due to the lack of previous experience and the procedure-related pain (Astramskaite *et al.*, 2016; Yıldizer Keris, 2017; Yıldırım *et al.*, 2018). Although dental radiology does not make use of potentially anxiogenic objects and instruments, such as needles for local anesthesia, burs, and dental handpieces (Doebling & Rowe, 2000; Oosterink *et al.*, 2008) anxiety should not be underestimated because, unlike other dental specialties, patients are exposed to ionizing radiation (Doebling & Rowe). Additionally, the robustness of the radiological equipment, e.g. panoramic radiography and cone beam computed tomography (CBCT), may

scare patients and increase their level of anxiety (Spin-Neto & Wenzel, 2016; Yıldizer Keris).

The detection of anxiety can be accomplished through questionnaires and specific biological markers. Questionnaires detect and track anxiety levels (Said *et al.*, 2013; Karibe *et al.*, 2014; Yıldizer Keris), and their reliability depend on the self-perception and sincerity of the applicants. More objectively, the physiological investigation of anxiety can be estimated by the activity of alpha-amylase, which is an enzyme released in higher amount after the sympathetic-adrenomedullary axis activation under stressful situations (Rohleder & Nater, 2009). This biological

<sup>1</sup> Division of Oral Radiology, Department of Oral Diagnosis, Piracicaba Dental School, University of Campinas. Piracicaba, São Paulo, Brazil.

<sup>2</sup> Department of Pediatric Dentistry, Piracicaba Dental School, University of Campinas, Piracicaba, Brazil.

<sup>3</sup> Department of Social Dentistry, Piracicaba Dental School, University of Campinas, Piracicaba, São Paulo, Brazil.

marker is very sensitive and can be non-invasively obtained from the patient's saliva (Said *et al.*; Karibe *et al.*; Rohleder & Nater). Previous studies have confirmed the applicability of alpha-amylase for the detection of dental anxiety (Furlan *et al.*, 2012; Karibe *et al.*; Salas Huamani *et al.*, 2019).

Due to the indication of the radiographic examination in the most diverse dental specialties, it is essential that professionals and dentistry students understand the patients' experience during these examinations, aiming to avoid the need for repetitions, in addition to offering minimally traumatic treatment. However, this is a considerable challenge in daily routine because some patients have difficulty in expressing themselves clearly. Then, the biomarker alpha amylase can help professionals in such task and potentially lead to better patient management. Thus, the aim of this study was to verify patients' anxiety levels related to dental radiographic examinations in addition to dentists' perception and management.

## MATERIAL AND METHOD

This study was approved by the local ethics committee (CAAE: 91084418.2.0000.5418), and all the participants signed an informed consent form.

### Patient anxiety assessment

**Sample selection and characterization.** Forty-seven patients older than 18 years of age and undergoing panoramic radiography or CBCT using the OP300 Maxio unit (Instrumentarium Imaging, Tuusula, Finland) were randomly selected from an oral radiology clinic.

Exclusion criteria considered patients with potential alterations in alpha-amylase levels due to the following variables: fasting less than 1 hour, coffee and alcoholic beverages intake, physical exercise one hour before the radiographic examination, and smokers with xerostomia or under beta-blockers treatment (Said *et al.*; Rohleder & Nater). Patients with systemic diseases that affect movement, such as Parkinson's disease, were also excluded.

Out of the total selected sample of patients, 76.6 % of them were female, 78.7 % underwent panoramic radiography, 51.1 % had the exam prescribed for overall evaluation of the jaws, and 57.4 % had previous experience with radiographic examination. The mean age was of 34 years old (standard deviation of 17.4 years) (Table I).

The sample size of patients was calculated based on a study that assessed anxiety levels through alpha-amylase activity in dentistry (Sadi *et al.*) with a power test higher than 80 %, error type I and significance level of 5 %.

**Saliva collection.** Saliva was collected twice from the selected patients ten minutes before and ten minutes after the radiographic examinations using a cotton swab and a plastic tube (Salivette, Sarstedt, Germany). The swab was placed under the patient's tongue to get entirely imbibed with saliva for about 2 minutes, and the collected material was centrifuged at 16097.2 g (3000 rpm for 15 minutes). The debris was discarded and the supernatant was kept at -80oC for the analysis (Furlan *et al.*). The collection procedures were done only in the afternoon between 2-4 pm to avoid variation of the circadian rhythm (Rohleder & Nater).

**Alpha-amylase dosage.** The collected saliva was assayed for alpha-amylase activity using an immunoassay kit (ELISA) according to the manufacturer's instructions (Salimetrics, Carlsbad, CA, USA). The enzymatic kinetics of alpha-amylase was measured by spectrophotometry at absorbance of 405 nm at 37 °C (Eon, BioTek Instruments, Winooski, VT, USA) (Furlan *et al.*; Salas Huamani *et al.*), and expressed as international units per milliliter of saliva (U/mL)

Table I. Characterization of the patients included in this study.

	Variable	N
Sex [n(%)]	Female	36 (76.6 %)
	Male	11 (23.4 %)
Age [years (SD)]		34 (17.4)
Imaging modality	Panoramic radiography	37 (78.7 %)
	Cone-beam computed tomography	10 (21.3 %)
Examination indication	General evaluation	24 (51.1 %)
	Tooth extraction planning	21 (44.7 %)
	Bony lesion evaluation	2 (4.2 %)
Previous experience	Yes	27 (57.4 %)
	No	20 (42.5 %)

(Rohleder & Nater; Furlan *et al.*; Salas Huamani *et al.*). As proposed by Bradford (1976), the total protein concentration in saliva normalized the alpha-amylase activity (Furlan *et al.*) using the Bradford reagent (Sigma Aldrich, Saint Louis, MO, USA) and bovine serum albumin (Sigma-Aldrich, Jurubatuba-SP, Brasil) as standard, with concentrations of 0.5, 0.25, 0.125 and 0.06 mg/mL and the values were converted to U/mg of total protein.

**Patient interview.** After the radiographic examination and the final saliva collection, sex and examination indication were collected. The patients were interviewed to evaluate the anxiety level by the time the examination was scheduled and during the procedure itself, and the occurrence of physical manifestations of anxiety, such as muscle tension, restlessness, sweating, increased respiratory and heart rate (Yildizer Keris; Furlan *et al.*; Salas Huamani *et al.*), through a previously tested form. The interview

questions, as detailed in Table II in the results section, were elaborated by experienced professors of psychology and oral radiology, who followed the yes/no format, along with “does not apply”.

**Statistical analysis.** The Wilcoxon test compared the alpha-amylase activity before and after the radiological examinations. The Mann-Whitney test was used to assess differences between males and females, and between patients with and without previous experience with radiographic examinations. All tests were performed using the software GraphPad Prism 7.04 (GraphPad Software, Inc; La Jolla, California, USA) at a significance level of 5 % ( $\alpha=0.05$ ).

#### Dentist perception on patient anxiety assessment

**Sample selection.** Fifty dentists were invited to share their perception on their patients' anxiety levels related to dental imaging examinations used in their clinical

Table II. Absolute and relative frequency of potentially anxiogenic variables associated with radiographic imaging examinations.

Questions	Yes	No
<b>My ANXIETY / FEAR...</b>		
1. made me postpone the examination appointment	1 (2.1)	46 (97.9)
2. made me cancel or not attend the examination appointment	1 (2.1)	46 (97.9)
3. would make me (for females) postpone/cancel the examination if I was pregnant or (for males) prevent my wife from taking the examination if she was pregnant.	37 (78.7)	10 (21.3)
<b>ON THE DAY OF THE RADIOGRAPHIC EXAMINATION, I EXPERIENCED ANXIETY / FEAR...</b>		
4. in the waiting room	9 (19.2)	38 (80.8)
5. when called by the dentist to be radiographed	9 (19.2)	38 (80.8)
6. inside the X-ray examination room	8 (17.0)	39 (83.0)
7. when was being positioned by the dentist to perform the X-ray	26 (55.3)	21 (44.7)
8. when the dentist left the room and I heard an alarm from the X-ray machine	8 (17.0)	39 (83.0)
9. when I saw the radiographic image of my teeth on the computer monitor	17 (36.2)	30 (63.2)
10. when the dentist needed to repeat the radiographic examination	6 (12.7)	41 (87.2)
11. when the X-ray examination ended	1 (2.1)	46 (97.9)
12. while waiting for the radiographic report	11 (23.4)	36 (76.6)
13. as a consequence of pain when radiographs were being taken	2 (4.2)	45 (95.7)
14. from the X-ray exposure	8 (17.0)	39 (83.0)
<b>DURING THE RADIOGRAPHIC EXAMINATION...</b>		
15. I felt my muscles tensed	22 (46.8)	25 (53.2)
16. my breathing rate increased	7 (14.9)	40 (85.1)
17. I sweat	2 (4.2)	45 (95.7)
18. I had nausea or stomachache	1 (2.1)	46 (97.9)
19. my heart rate increased	21 (44.7)	26 (55.3)

Table III. Characterization of the dentists included in this study.

Variables	Dentists			Total	
	Oral Radiologists	Dental Practitioners	Pediatric Dentists		
Sex [n (%)]	Female	11 (57.9)	13 (76.5)	10 (71.4)	34 (68.0)
	Male	8 (42.1)	4 (23.5)	4 (28.6)	16 (32.0)
Age [years (SD)]	29.1 (4.8)	32.7 (6.9)	34.0 (9.3)	31.7 (7.2)	
Working experience [years (SD)]	6.4 (4.6)	9.1 (6.3)	10.4 (9.2)	8.4 (6.8)	

SD – Standard deviation

routine by means of a qualitative-quantitative approach (Lefèvre & Lefèvre, 2003; Costa *et al.*, 2016, 2020).

For this assessment method, the sample size of 50 dentists was sufficient to reach saturation, which is when the answers no longer reveal new information (Vazquez *et al.*, 2015). Most of the dentists were female (68 %), the mean age was of 32.1 years old (standard deviation of 7.6 years), and the pediatric dentists were the most experienced professionals working for an average of 10.4 years (standard deviation of 9.2 years) (Table III). All selected dentists had, at least, two years of clinical experience and were occasionally distributed in 19 (38 %) oral radiologists, 17 (34 %) general practitioners and 14 (28 %) pediatric dentists. In this study, the oral radiologists acquired extraoral radiographic images in adult patients whereas general and pediatric dentists acquired intraoral radiographic images in adults and children, respectively.

**Dentist interview.** The selected dentists were asked to answer the following two guiding questions: "How do you reassure patients with anxiety or fear of radiographic examinations?" and "How do you perceive the patients' anxiety?".

One researcher interviewed individually all dentists in a calm and quiet place using a voice recorder, and the answers were fully transcribed immediately after each interview to verify the saturation of responses (Costa *et al.*, 2020; Vazquez *et al.*). When saturation was reached, the qualitative-quantitative analysis was initiated.

**Qualitative-quantitative analysis.** To assure that the data were verified from more than one perspective, two researchers individually selected the most significant aspects of the responses of each dentist (key expressions). Posteriorly, in consensus, the researchers confronted the key expressions obtained, which were synthesized in central ideas and grouped (Mialhe *et al.*, 2011; Lefèvre & Lefèvre; Costa *et al.*,

2016, 2020) (Table IV). This qualitative assessment generated the "discourse of the collective subject", a text in the first-person singular in which the perceptions and behaviors of the dentists were described as an individual discourse, respecting their colloquial language (Lefèvre & Lefèvre; Costa *et al.*, 2016, 2020). After, the frequency of participants who shared similar ideas (quantitative part) was calculated (Costa *et al.*, 2016; Mialhe *et al.*). The Qualiquantisoft® software (SPI - Sales & Pascoal Company, São Paulo, SP, Brazil) was used for this analysis.

## RESULTS

Table V shows that, before the radiographic examination, the alpha-amylase activity was significantly lower for males ( $p \leq 0.05$ ) than for females, who had the same level of alpha-amylase activity after the exam ( $p > 0.05$ ). For men, the alpha-amylase activity increased after the exam ( $p \leq 0.05$ ), presenting similar alpha-amylase activity as women ( $p > 0.05$ ). Patients with no previous experience with radiographic exams presented a significant increase of the alpha-amylase activity after the exam ( $p \leq 0.05$ ), and no significant difference was observed between the assessment times (before and after the radiographic exam) for patients with previous experience ( $p > 0.05$ ). When compared to panoramic radiography, CBCT led to a significant increase of the alpha-amylase activity after the exam ( $p \leq 0.05$ ), and there were no significant differences before and after the exam for patients who underwent panoramic radiography ( $p > 0.05$ ).

Most of the patients reported that anxiety/fear would make them postpone or cancel the radiographic exam appointment in case of pregnancy (78.7 %), and that they experienced anxiety when they were being positioned in the machine (55.3 %). Regarding the physiological responses of anxiety, most of the answers were positive for muscle tension (46.8 % of patients),

Table IV. Resulting central ideas and discourses of the collective subject, and the absolute and relative (in percentage) numbers of respondents [radiologists (n = 19), clinicians (n = 17) and pediatric dentists (n = 14)], with regard to two questions on the patients' anxiety related to radiographic examinations.

Central Ideas*	Dentists			Question: How do you reassure patients with anxiety or fear of radiographic exams?
	Oral Radiologists	General Practitioners	Pediatric Dentists	
A. Explanation of the exam in simple language	12 (63.2)	6 (35.3)	-	"I explain the exam in clear and comprehensible language."
B. Explanation of the importance of the exam for diagnosis	4 (21.0)	7 (41.2)	-	"I explain that the radiographic exam is important to complement the diagnosis and treatment planning."
C. Explanation of the exam in playful language	-	-	14 (100%)	"For children, I compare the radiograph with a photograph by telling them that we are going to take a picture of the tooth. Also, I say that the exam is fast and that a quick beep will sound. I show the equipment and let them hold the image receptor. Regarding the shielding, I also explain that they have to wear a cape just like Superman." "With regard to intra-oral radiography, I make it clear that the exam does not cause major pain, except for a discomfort when positioning the bite block inside the mouth." "With regard to extra-oral techniques, I explain the movement of the machine, the relatively short acquisition time, and the importance of standing still until the end of the exam." "I say that the radiation dose from dental radiographic examinations is low."
D. Explanation of radiographic intraoral techniques	2 (10.5)	4 (23.5)	-	"For better understanding of the radiation doses, I compare them with sunlight."
E. Explanation of radiographic extraoral techniques	6 (31.6)	-	-	"I highlight the shielding effect of the lead apron and thyroid collar during the exams."
F. Explanation of radiation exposure	10 (52.6)	7 (41.2)	-	"I carefully explain the exam for all patients, even when they seem to be calm. I believe some patients may not feel comfortable to demonstrate their anxiety."
G. Radiation dose comparisons	9 (47.4)	-	-	"I only explain the exam when I realize the patient is anxious."
H. Radioprotection information	6 (31.6)	5 (29.4)	-	"I try to explain the exam for the parents and for all children who demonstrate imaging exams-related anxiety".
I. Explanation of the exam for all patients	6 (31.6)	4 (23.5)	-	"I carefully explain the exam only for patients who have never been imaged before."
J. Explanation of the exam for anxious patients only	12 (63.2)	4 (23.5)	14 (100%)	"I hardly have anxious patients or afraid of the radiographic exam. Generally, patients do not ask questions about the radiographic exam; they are pretty quiet about that."
L. Explanation of the exam for anxious parents and children	-	-	-	Question: How do you perceive the patients' anxiety? "By the patients' facial expressions or when they look apprehensive. Some patients begin to sweat, become restless, trembling, nervous, and tense. Some patients report previous negative experience, such as nausea."
M. Explanation of the exam for inexperienced patients	-	2 (11.8)	-	
N. Never treat anxious patients	-	7 (41.2)	-	
To be continued				
Continuation				
A. Physiological responses	7 (36.8)	6 (35.3)	-	
B. Behavior	1 (5.3)	-	14 (100%)	"When they (children) hide behind their parents, start crying, have tantrums, sweat, and avoid going to the X-ray room".
C. Exam questioning	14 (73.7)	10 (58.8)	-	"When they ask many questions about the procedure. Some are concerned about the risk of developing cancer based on what they learned from the internet, television, or friends' comments. Some ask about the use of the lead apron and thyroid collar."

\*The same participant may present more than one "central idea."

followed by an increase in the heart rate (44.7 % of the patients) (Table II).

The assessment of the dentists' perception on their patients' anxiety resulted in the discourse of the collective subject (Table IV) and the identification of the following central ideas:

**- Strategies to reassure patients with anxiety or fear of radiographic examinations:**

**Oral radiologists and General practitioners -**

Explanation of the examination in simple language; explanation of the importance of the examinations for the diagnosis; explanation of the radiation exposure; radiation dose comparisons; explanation of the exam for anxious patients only.

**Oral Radiologists** – Further explanation on radiation dose comparisons.

**General Practitioners** - Never treated anxious patients.

**Pediatric Dentists** - Explanation of the exam in playful language; explanation of the exam for anxious parents and children.

**- Perception the patients' anxiety:**

**Oral Radiologists and General Practitioners -** Physiological responses; exam questioning.

**Pediatric Dentists** – Behavior.

To reassure patients about the radiographic exam, oral radiologists reported that they explain the full examination in simple language, tell the patients that the radiation dose of the dental radiographic exams is low, and make it more understandable by comparing the radiation dose with sunlight. However, oral radiologists reported that they only provide such explanations when the patient demonstrates anxiety, which is perceived when they ask questions about the exams, mostly about the radiation-related risks and protection (Table IV).

General practitioners reported that they explain the importance of the radiographic exams in the diagnostic process, and also the relatively low radiation dose. However, they consider that patients have no fear or anxiety with the radiographic examinations and, similarly to oral radiologists, general practitioners perceive anxiety from the patients' reports (Table IV). All pediatric dentists reported that they use playful language to reassure children about the radiographic examination, and that anxiety is perceived by their behavior (Table IV).

**DISCUSSION**

The present study investigated patients' anxiety levels related to dental radiographic examinations and dentists' perception and management. Specialists in oral radiology, general practitioners, and pediatric dentists who acquire radiographic images in their clinical routine participated of this study. In addition,

Table V. Medians and interquartile ranges of alpha-amylase activity (U/mL) before and after the radiologic examination as a function of the sex, previous experience with the examination and the imaging modality.

Variables		Before	After	p-value
Sex	Female	25.51 (19.85)	28.59 (17.60)	0.074
	Male	14.01 (8.60)	27.98 (14.60)	0.028*
	p-value	0.021*	0.619	
Previous experience	Yes	25.51 (18.64)	27.19 (9.66)	0.375
	No	19.12 (15.67)	34.01 (28.73)	0.004*
	p-value	0.361	0.315	
Imaging modality	Panoramic radiography	19.58 (14.28)	25.56 (11.34)	0.199
	CBCT	26.22 (27.40)	32.05 (28.23)	0.050*
	p-value	0.259	0.070	

\*Statistically significant (p<0.05). The p-values in the last column are for comparisons between before and after the radiologic examination (Wilcoxon test). The p-values in the bottom of each group of variables are for comparisons between independent variables (Mann-Whitney test).

pediatric dentists also participated, due to the specific anxiety of children with the dental environment (Karibe *et al.*; Salas Huamani *et al.*).

The results showed that, for most of the oral radiologists (73.7 %) and general practitioners (58.8 %), anxiety is perceived only when their patients report it. However, it is important to consider that patients not always verbalize that they are anxious possibly because they feel embarrassed, unlike children who easily demonstrate anxiety through disruptive behaviors, which can be easily detected. Thus, to avoid bias related to the patients' reports, anxiety was assessed through a biological marker, which showed significant differences in alpha-amylase activity before and after the radiographic exam, and is indicative of anxiety (Karibe *et al.*; Furlan *et al.*; Salas Huamani *et al.*).

In relation to sex, alpha-amylase activity was significantly higher before the radiographic exam for women, whereas for men, the activity was significantly higher after the exam. According to the literature, women present more dental anxiety than men (Astramskaite *et al.*; Yıldırım *et al.*; Ihara *et al.*, 2018), and this reaction can be explained due to the related cerebral differences, which are responsible for increased anxiety or phobias among women (Astramskaite *et al.*; Yıldırım *et al.*). According to Wabnegger *et al.* (2014), women has higher percentage of grey matter in comparison to men, which might influence behaviors such as dental anxiety. The most frequently reported physiological response to anxiety was muscle tension (46.8 %) followed by an increase in heart rate (44.7 %), probably due to the positioning in the device (55.3 %) and the expectation of the exam end.

Patients who underwent magnetic resonance imaging (Eshed *et al.*, 2007) and multi-slice computed tomography (Heyer *et al.*, 2015) experienced more considerable discomfort when the exam was performed in the head and neck region than in other regions of the body due to claustrophobia generated when entering the gantry. In oral radiology, extraoral devices present varying physical configurations and tend to be less intimidating for the patients. Even though, patients may not have a total perception of the device operation, and anxiety may be generated due to a lack of control over the procedure. In the present study, although the positioning of the patients was similar for panoramic radiography and CBCT, the alpha-amylase activity was significantly higher after the CBCT, which may

be related to the slightly longer acquisition time in CBCT, and consequent increase of anxiety.

From a clinical perspective, a greater difficulty and increased time for patient positioning is observed in women before the radiographic exam. For men, the increased anxiety level after the exam may be related to insecurity, impatience, and discomfort due to the positioning in the device, which may lead to greater resistance of undergoing to radiographic exams in the future.

A previous study (Chapman *et al.*, 2010) revealed that anxiety levels were higher in patients undergoing magnetic resonance imaging who had never been in contact with this imaging modality before, and lower in a second session. This was also confirmed in the present study since patients with no previous experience had a significantly higher alpha-amylase activity after the test probably because they were not familiar with the operation of the machine. This highlights the importance of a complete explanation to patients on the image acquisition process. Previous studies have found that patients have limited knowledge regarding medical imaging exams such as multi-slice computed tomography (Heyer *et al.*) and magnetic resonance imaging.<sup>26</sup> The lack of clear professional-patient communication (Heyer *et al.*) can lead to patient insecurity and be an additional factor in increasing anxiety level (Munn & Jordan, 2011; Heyer *et al.*; Tugwell-Allsup & Pritchard, 2018). Thus, a detailed explanation to patients on the image acquisition process and radiation protection is extremely important.

To reassure patients about imaging examinations-related anxiety, most oral radiologists reported that they provide explanations in accessible language about the procedures required during the examination. Similarly, the pediatric dentists reported that make use of playful language. Among the general practitioners, the most common approach was to emphasize the importance of the radiographic examination to complement the clinical diagnosis. The concern for the findings or diagnosis has also been considered as an anxiogenic factor in medical imaging (Heyer *et al.*; Chapman *et al.*; Munn & Jordan; Tugwell-Allsup & Pritchard). However, most of the examinations used in this study had as a clinical task the overall evaluation of the oral cavity, which may have been the cause of few patients showing lower anxiety levels related to the visualization of the image and the imaging report.

In the present study, few patients reported anxiety related to the ionizing radiation associated risks, which may suggest limited knowledge on this topic. Similar results were found in studies with patients undergoing multi-slice computed tomography examinations (Ludwig & Turner, 2002; Baumann *et al.*, 2011). Another interesting finding of the present study regarding exposure to radiation was the fact that pediatric dentists did not report whether their patients' parents expressed anxiety when radiographic examinations were indicated for their kids. Chiri *et al.* (2013) found that, although the parents had a good perception of the diagnostic value of X-rays, most of them were unaware of the exposure risks and the increased radiosensitivity of children.

Regarding explaining the patients about the radiation dose employed in dental examinations, a considerable number of oral radiologists was concerned to compare the radiation dose of the examinations with sunlight. According to Ludwig & Turner, this approach is beneficial because patients understand well the harmful effects of solar radiation even having limited knowledge about the radiation dose of the imaging examinations. General practitioners reported informing their patients that radiation dose is low in oral radiographic examinations, although they believe that patients are not anxious about it. Another interesting finding was that most patients revealed overestimated precaution by stating that the radiographic examination should be avoided in case of pregnancy, which opposes their underestimation of personal risks. It is suggested that such a reaction is probably due to common sense media or the warning board hanging on the wall.

Dentists should take into consideration individual previous experience of patients and how familiar they are with the examination and radiation protection concepts. Also, professionals and dentistry students should instruct patients in a language of easy understanding for a better comprehension of the procedures. Future studies should be performed to evaluate strategies to maximally reduce the anxiety of patients and its manifestations in the radiology clinic, reducing the need for retakes.

## CONCLUSION

Dental radiographic examinations may be a source of anxiety with salivary alpha-amylase levels depending on the patient's gender and experience,

imaging modality, and moment in relation to the image acquisition. Dentists perceive anxiety in adult and pediatric patients differently.

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**RESUMEN:** Este estudio evaluó los niveles de ansiedad en los pacientes relacionados con exámenes radiográficos dentales, además de la percepción y el manejo de los dentistas. Se midió la actividad de la alfa-amilasa salival (sAA) de 47 pacientes antes y después de la exposición a exámenes radiográficos para evaluar su nivel de ansiedad y se comparó mediante la prueba de Wilcoxon. La prueba de Mann-Whitney evaluó la actividad de la sAA relacionada con el sexo, el tipo de examen y la experiencia previa con exámenes radiográficos. Se entrevistó a 50 dentistas utilizando un guión semiestructurado de preguntas abiertas sobre la percepción de la ansiedad de sus pacientes. Antes del examen radiográfico, la actividad de la sAA era significativamente mayor para las mujeres ( $p \leq 0.05$ ). La actividad de SAA aumentó significativamente después del examen para los hombres, pacientes de ambos sexos sin experiencia previa y para los que se sometieron a CBCT ( $p \leq 0.05$ ). Se informó que se observa ansiedad en el habla de los pacientes adultos y en el comportamiento de los pacientes pediátricos. Los exámenes radiográficos dentales pueden ser una fuente de ansiedad para las mujeres antes del examen. Tras la exploración, los hombres, los pacientes sin experiencia previa y los sometidos a CBCT presentan niveles de ansiedad más elevados. Los dentistas perciben la ansiedad en los pacientes adultos y pacientes pediátricos de manera diferente.

**PALABRAS CLAVE:** ansiedad, alfa-amilasas, radiología, odontología, atención al paciente.

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Corresponding author:

Eliana Dantas Costa  
Division of Oral Radiology  
Department of Oral Diagnosis  
Piracicaba Dental School  
University of Campinas  
Av. Limeira 901  
Areião, Piracicaba  
SP. Zip Code 13414-018  
BRAZIL

E-mail: edantasc@yahoo.com.br