

Prevalence of radiolucid periapical injury in patients with primary Sjögren syndrome

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ABSTRACT

Introduction: Patients with Primary Sjögren Syndrome (PSS) have a higher incidence of dental caries. As a consequence, radiolucent periapical lesions (RPL) may appear.

Objective: To determine the prevalence of RPL in patients with PSS and to radiologically characterize the teeth associated with RPL. **Methodology:** Cross-sectional study involving patients with PSS, recruited at the Rheumatology Clinic (HUCAM-ES), who were initially submitted to a socioeconomic questionnaire and clinical evaluation of salivary flow. Subsequently, radiographs were obtained by a digital intra-oral system with positioner for the periapical parallelism technique. Descriptive statistics were calculated by the mean and standard deviation for quantitative variables, and absolute

and relative frequencies for qualitative variables. Chi-square test with 95% CI and Student t test were applied to compare patients with and without periapical lesion. **Results:** Overall, 24 patients participated in the study and all were females (20-71 years). The mean number of teeth per patient was 23.3 ± 3.1 , with prevalence of dental RPL of 7.86%. Among all patients, 70.8% had at least one RPL. When comparing teeth with and without RPL, teeth with RPL showed higher percentage of treated canal and caries. **Conclusion:** According to the results, it can be concluded that RPL in patients with PSS is a frequent condition, especially when associated with teeth with obturated root canals.

Keywords: Periapical Diseases. Sjogren's Syndrome. Prevalence.

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Introduction

The Primary Sjögren Syndrome (PSS) is a chronic autoimmune disease that affects the salivary glands, leading to hyposalivation,¹ which can result in high incidence of caries, tooth loss and greater periodontal involvement.^{2,3,4,5,6} One of the sequelae of caries is chronic apical periodontitis, radiographically characterized as a radiolucent periapical lesion (RPL) surrounding the apex of the affected tooth.⁷ This lesion leads to the presence of microorganisms colonizing the root canal system, which in adverse conditions release antigens in the periradicular or periapical area,⁸ inducing inflammatory and immune response and consequently osteoclast activation, with destruction of bone and periodontal ligament.⁹ The immune system is not able to solve the odontogenic infection; however, the inflammatory response in the periapex moderates the microbial dissemination through the periapical tissues.¹⁰ It is known that patients with PSS may have higher concentration of some important cytokines in the gingival crevicular fluid, saliva and peripheral blood,^{3,11} expanding the inflammatory cascade.^{11,12} Additionally, collections of lymphocytes around the salivary ducts in patients with PSS produce an inflammatory process that damages them, precluding their normal function. Thus, this suggests that the salivary ducts play an important role in the process leading to local immune response.¹³ However, the literature on the pathogenesis, progression and endodontic healing in patients with PSS is remarkably scarce. Considering that the role of bacteria and the host response are two processes deeply involved in periapical health, a worse response to colonization and infection by pathogens is suspected in patients with PSS. Thus, this study aimed to determine the prevalence of RPL in patients with PSS and to radiologically characterize the teeth associated with RPL.

Methodology

Cross-sectional study involving patients with PSS recruited at the Rheumatology Clinic of the University Hospital Cassiano Antônio de Moraes (HUCAM-ES), diagnosed according to the European-American Classification Criteria for diagnosis of PSS.¹⁴ This study was approved by the Institutional Review Board of HUCAM-ES, at the Federal

University of Espírito Santo (UFES), under number 1.698.971. All volunteers were informed about the study objectives and methods and signed a consent form agreeing to participate.

The total sample consisted of 30 patients submitted to the socioeconomic questionnaire and test for evaluation of salivary flow; however, for the accomplishment of radiographs, only 24 patients returned to the clinic. The included patients had the following eligibility criteria: at least 15 natural teeth, no use of antibiotics in the last three months, no periodontal treatment in the last six months, no systemic diseases that might affect the periodontal health and not being in the puerperal period.

The following sociodemographic and oral variables were considered: sex, age, race/ethnicity, socioeconomic status, xerostomia, hyposalivation, last dental consultation (less than one year/more than one year). The socioeconomic status was based on the ABEP classification,¹⁵ which considers D/E the poorest and A/B the best.

Patients with dry mouth symptoms were categorized with xerostomia, which is frequently associated with a decrease in salivary flow rate, which can be caused by quantitative or qualitative change of saliva.¹⁶ Conversely, hyposalivation is defined as a non-stimulated salivary flow lower than or equal to 0.1 milliliter per minute.¹⁴

The individuals were instructed to refrain from eating and drinking for 1 hour before collection. The saliva samples were collected between 9 and 11 am to avoid circadian variations. The patients were instructed to spit all the saliva in a pre-weighed disposable plastic cup. The saliva samples were weighed on a precision digital scale (BEL, Analytical Equipments, São Paulo, Brazil) model Mark 160 class 2. The weight of one gram of saliva is almost equivalent to the volume of 1 milliliter (ml). The salivary flow was calculated with the total value of produced saliva expressed in ml divided by the period of 5 minutes. Salivary flow rate below 0.1 ml/min was considered hyposalivation.¹⁴

The radiographs were obtained using periapical phosphor plates (2 x 4 mm) with an intraoral digital system (Vista Scan, Dürr Dental, Beitigheim-Bissingen, Germany), as well as a positioner for the periapical parallelism technique (Rinn-XCP, Dentsp-

ly, York, Pennsylvania, USA). All radiographs were taken by an experienced operator, on a single X-ray machine (Timex 70E, Gnatus, Ribeirão Preto, SP, Brazil) operating at 70kVp and 7mA, with exposure time ranging from 0.50 to 0.63s. For radiographic survey, all teeth were radiographed except for the third molars. The radiographs should have a good quality of technical standard, maximum sharpness, minimum distortion and medium degree of density and contrast. Subsequently, digital radiographs were exported in TIFF format and evaluated by a radiologist using the Image J software (National Institutes of Health, Bethesda, Maryland, USA).¹⁷ The reference to calibrate the digital image was the natural size of an adult periapical intraoral plate (3x4).

The following information was recorded: total number of teeth, number of periapical lesions, location (maxilla/mandible), region (anterior/posterior) and sextant (upper right, upper central, upper left, lower left, lower central, lower right) of teeth with RPL and radiological situation of the tooth (obturated canal, carious or intact). All radiographs were evaluated by two calibrated examiners (Kappa=0.86), one of whom was an experienced radiologist. The teeth were classified as endodontically treated if a radiopaque material was radiographically evident filling the root canals.

The periapical radiolucent lesions were defined based on the following criteria:¹⁸ enlargement of periodontal ligament or periapical radiolucency (radiolucency in contact with the apical portion of the root, exceeding at least twice the width of the lateral part of the periodontal ligament).

The software used for statistical analysis was IBM SPSS Statistics version 24. First, descriptive statistics was applied for all variables used in the study, calculating the mean and standard deviation for quantitative variables, and absolute and relative frequencies for qualitative variables. Subsequently,

the chi-square test with 95% CI was applied to compare the difference between proportions of qualitative variables and the Student t test to compare the means of quantitative variables between patients with and without periapical lesion.

Results

A total of 24 patients with PSS were analyzed. All patients were females, of admixed ethnicity, mostly of low income, with mean age 51.7 ± 11.67 years. Also, 80% reported hyposalivation and all reported dry mouth. Among all patients, 70.8% (n=17) had at least one tooth with obturated canal, 70.8% (n=17) with at least one RPL (Table 1).

Among the 17 patients who had at least one lesion, 10 (58.8%) had one or two lesions, and the remaining had 3 or more. The mean number of lesions per patient was 1.83 ± 1.88 . Comparison of patients with and without RPL revealed that the mean age for patients with RPL was 52.5 ± 8.5 , compared to 49.7 ± 17.9 for patients without RPL (p=0.703). Also, patients without RPL had 28.6% (n=2) of normal salivation, compared to 5.9% for patients with RPL (n=1) (p=0.194).

A total of 303 radiographs (560 teeth) were analyzed, and each patient had between 15 and 28 teeth. The mean number of teeth per patient was 23.3 ± 3.19 and the prevalence of RPL in teeth was 7.86%. Comparison of teeth with and without RPL evidenced that teeth with RPL had a higher percentage of filled canals and caries (p<0.001) and were located mainly in the upper central sextant (p=0.003). Among the 44 teeth with RPL, half were in the maxilla and half in the mandible (p=0.941) (Table 2). The teeth most affected by RPL were the upper central incisors, with lesions present in five patients, followed by the upper with lesion in four patients, and the first lower premolar, first and second lower molars, with lesions in three patients each.

Table 1. Sociodemographic and oral characteristics of patients with Primary Sjögren Syndrome.

Variables		n = 24	%
Race/Ethnicity	White	8	33.3
	Admixed	12	50.0
	Black	4	16.7
Socioeconomic status	A/B	4	16.7
	C/D/E	20	83.3
Xerostomia	No	0	0
	Yes	24	100.0
Hyposalivation	Normal	3	12.5
	Yes	21	87.5
Last dental consultation	Less than 1 year	13	54.2
	More than 1 year	11	45.8
At least one periapical lesion	No	7	29.2
	Yes	17	70.8
At least one tooth with obturated root canal	No	7	29.2
	Yes	17	70.8

Table 2. Characteristics of radiolucent periapical lesions of patients with Primary Sjögren Syndrome.

		Total number of teeth	Periapical lesion		χ^2 (p)
			Present n (%)	Absent n (%)	
Location	Maxilla	283	22 (50.0)	261 (50.6)	0.941
	Mandible	277	22 (50.0)	255 (49.4)	
Region	Anterior	278	21 (47.7)	257 (49.8)	0.791
	Posterior	282	23 (52.3)	259 (50.2)	
Radiological status of the tooth	Intact	415	10 (22.7)	405 (78.5)	<0.001*
	Carious	72	11 (25.0)	61 (11.8)	
	Obturated root canal	73	23 (52.3)	50 (9.7)	
Sextant	Upper right	74	3 (6.8)	71 (13.8)	0.003*
	Upper central	134	17 (38.6)	117 (22.7)	
	Upper left	96	5 (11.4)	91 (17.6)	
	Lower left	47	8 (18.2)	39 (7.6)	
	Lower central	144	4 (9.1)	140 (27.1)	
	Lower right	65	7 (15.9)	58 (11.2)	

*Chi-square p<0.05

Discussion

This study provided data on the prevalence of RPL in patients with PSS. Epidemiological studies on the prevalence of RPL in different countries revealed that RPL is a generalized oral health problem that can compromise the systemic health.¹⁹ Although a causal relationship has not been established between RPL and some diseases as diabetes mellitus,¹⁹ these findings contributed to promote greater attention to the oral health of these patients. In addition, further investigations are conducted on the possible association with other diseases in endodontic pathology.^{20,21}

This study excluded patients with systemic diseases that affected periodontal health, such as diabetes¹⁹ and HIV.²² Thus, the influence of these diseases for the appearance of periapical lesions can be reduced. Other authors, in similar studies, excluded teeth with restorations or defects, teeth with periradicular tissues close to radiolucent anatomical structures or obturated teeth with inadequate root canal treatment.²³ However, these exclusions necessarily change the results and preclude the determination of the actual periapical condition of individuals.

The prevalence found in this study of 70.8% was higher than other investigations on the prevalence of RPL in the Brazilian population, ranging from 41.7%;²¹ 42.9%;²⁴ 51.4%;²⁵ to 61.2%.²⁶ In this study, all patients were females, which is justified by the consistent relationship between PSS and the female sex (9 females:1 male),²⁷ which could have contributed to the greater prevalence found, since the prevalence of RPL is higher in females,^{21,24,25,26} and most studies have a higher number of females in their samples.^{24,25,26}

The use of dental services is among the risk indicators that can be associated with the presence or absence of RPL.²⁶ The use of dental services for dental caries, pulpitis, gingivitis, stomatitis and periodontitis was significantly higher in patients with PSS during a period of 3 years before diagnosis of Sjögren syndrome compared to controls.⁴ In this study, most patients attended dental services less than one year before (Table 1), which could reflect a better general oral condition. This indicates that the dental treatment performed is not able to effectively prevent or cure the apical periodontitis, although the microbiological etiology and how to deal with microbial infection are well established.²⁸

When comparing the mean ages of patients with and without RPL, patients with RPL had higher mean age, in agreement with other studies.^{29,30} Although the evidence suggests an increased prevalence of RPL with age,^{29,30} the prevalence studies in patients with mean age higher than that of our study found lower prevalence of RPL,^{21,24} further demonstrating that the frequency of RPL did not vary significantly with age.²⁴ The hyposalivation found in most patients in this study may have contributed to this effect, since in patients with PSS, in the presence of hyposalivation, there is an increase in the number of acidophilic and cariogenic microorganisms when compared to control individuals,^{31,32} constituting a risk factor for progression and for a higher prevalence of caries,^{2,6} the main etiological factor of root canal infection and RPL.²⁰

There is a biological basis to suggest that PSS can lead to an increase in RPL. The overexpression of several inflammatory cytokines and lymphocytic sialadenitis demonstrated in PSS^{28,31} alters the immune responses to bacterial challenge in the periodontal environment.^{2,3,6} Also, in endodontic infections, high serum levels of inflammatory mediators were observed in patients with RPL.³² In addition, an initial response of lymphocytes, with subsequent activation of osteoclasts by the nuclear factor kappa B (RANKL), has been implicated in the progression of periapical bone destruction that characterizes apical periodontitis.³³

The literature on pathogenesis, progression and endodontic healing in patients with PSS is remarkably scarce, yet some studies in patients with alopecia areata (AA), an autoimmune disease, revealed that inflammatory phenomena that occur in response to pulp necrosis, opening doors to the entry of microorganisms into the periradicular zone, due to autoimmune reasons, stimulates the production of more inflammatory cells and can act as a “trigger” in the attack of anagen hair follicles.³⁴ One case of alopecia areata resulting from dental foci was effectively solved by eliminating a tooth infection by tooth extraction.³⁵ Such reasoning about the participation of pathogenesis of autoimmune disease associated with endodontic infection leads to infer that, once the infectious process is eliminated in patients with PSS, the clinical condition can be controlled and can aid in monitoring the systemic condition.

Periapical radiographs (PR) were obtained due to their availability and since they provide more accurate information for diagnosis when compared to the use of panoramic radiography.³⁶ Conversely, cone-beam computed tomography (CBCT) can provide more robust results, since it allows three-dimensional visualization of related anatomical structures with higher resolution, resulting in excellent diagnostic accuracy.³⁷ Therefore, the use of PR to detect RPL is a limitation in this study, thus suggesting the use of CBCT in future studies, offering greater accuracy in the diagnosis.

The frequency of teeth affected by RPL in this study was 7.86%, a prevalence also found by other authors.²⁶ However, among the endodontically treated teeth, the prevalence reported in the literature is significantly higher,^{20,21,24,25,26,29} in agreement with the present findings in which the RPL found were especially associated with teeth with obturated root canals. Studies show an association of inadequate endodontic treatment,^{24,25,38} especially in teeth with insufficient obturation when compared to excessive obturation,^{24,25} and a higher prevalence of RPL,^{24,25,38} however, the main focus of the study was not to determine the technical quality and result of endodontic treatment.

Other authors²⁶ also found a higher prevalence of RPL associated with upper central incisors. It is important to consider that digital periapical radiographs have greater sensitivity in detecting periapical osteolytic lesions in the anterior region,³⁹ which may have contributed to a better visualization and prevalence of RPL in this region. Higher prevalence of RPL was also found in the lower molars, which is consistent with the results of other authors.⁴⁰ The higher prevalence of molars may be related to their morphology, with multiple grooves that facilitate greater plaque retention, which contributes to a greater caries risk, besides the fact that they are the first permanent teeth to appear in the oral cavity.⁴¹

Even though radiographs provide a static image of a dynamic process, at the time of radiographic evaluation, RPL in an endodontically treated tooth may be evolving or healing. However, it was shown that the number of teeth with RPL that had regres-

sion after endodontic treatment compared to the number of endodontically treated teeth that developed new cases of apical periodontitis was similar in the same period.³⁸

Conclusion

According to the results, it can be concluded that the RPL found in patients with PSS is a frequent condition, especially when associated with teeth with obturated root canals.

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