PREVALENCE OF CHRONIC PERIAPICAL LESIONS IN DIABETIC VERSUS NON-DIABETIC PATIENTS: A RETROSPECTIVE STUDY

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ABSTRACT
Aim. The aim of study was to. evaluate the relationship between glycemic control and the presence of chronic apical periodontitis CAP in endodontically treated teeth among patients with type 2 diabetes, by comparing with those of a non-diabetic control group and analyzing differences according to sex and place of residence. *Materials and method*. This retrospective study evaluated the endodontic status of 90 patients with type 2 diabetes (mean age 60.13 years). All patients underwent fasting blood glucose and HbA1c testing, and data were collected regarding the number and location of endodontically treated teeth, both with and without chronic apical periodontitis (CAP). The prevalence and distribution of CAP were analyzed in relation to socio-demographic variables and compared to a non-diabetic control group, using descriptive and comparative statistical methods. *Results.*. Mean glycemia was 201.44 mg/dL in diabetic patients and 90.72 mg/dL in non-diabetic patients. The steepest glycemia increases were observed in female diabetic patients, with values rising from 207.47 mg/dL (0–1 teeth without CAP) to 382 mg/dL (≥ 4 teeth), and in urban diabetic patients, where glycemia increased from 179.43 mg/dL to 330 mg/dL; non-diabetic individuals maintained stable glycemia levels across all subgroups, with values generally ranging between 84.67 and 96.14 mg/dL. *Conclusions.* Glycemia levels were significantly higher and more variable in diabetic patients compared to non-diabetics, particularly as the number of endodontically treated teeth increased, with or without chronic apical periodontitis. The steepest rises were observed in female and urban diabetics, while non-diabetics maintained stable glycemia values across all subgroups.

Key words: chronic apical lesion, prevalence, root canal, diabetes

INTRODUCTION
Endodontic pathology, especially chronic periapical lesions, results from chronic inflammation of the root canal space that spreads to the periapical tissues. Globally, 52% of the adult population has at least one tooth affected by apical periodontitis, while 5% of all teeth are diagnosed with a periapical lesion [1].

In patients with diabetes mellitus, systemic hyperglycemia diminishes immune system function and tissue repair mechanisms, which may result in an increased prevalence and severity of chronic apical periodontitis (CAP). Endodontic treatment outcomes are also impaired: diabetic patients exhibit significantly slower healing of periapical tissues, reduced radiographic success, and a higher incidence of lesions that fail to heal compared to non-diabetic controls [2]. In addition, poor metabolic control is associated with impaired healing, and metabolic stability appears to be a prerequisite for successful endodontic therapy [3]. Poor glycemic control disrupts periapical responses—due to reduced mitogenic growth factors, elevated

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pro-inflammatory cytokines via epigenetic changes, and hyperglycemia-induced oxidative stress—which promotes both the onset and persistence of apical lesions [4], while oxidative stress further exacerbates diabetic complications through β-cell damage and endothelial dysfunction [5]. Impaired glucose metabolism in diabetic patients may accelerate osteoclast differentiation and is associated with reduced osteoblast numbers, while osteoblast growth and differentiation are particularly sensitive to osmotic stress, which may explain diabetes-related bone mass loss [6]. Given that diabetes mellitus ranks third among chronic medical conditions encountered in dental practice, endodontic specialists should be particularly attentive to the increased CAP risk in diabetic patients and its potential negative influence on glycemic control [7]. Effective therapeutic strategies should emphasize patient education, enhanced management of both glycemic levels and oral health, control of local inflammation, and the reduction or cessation of tobacco and alcohol consumption [8]. A complex approach of medical and dental treatment is required for the management of diabetic patients, with emphasis on blood glucose control and improving oral hygiene to ensure the best treatment outcome [9]. People with diabetes have poor knowledge of oral health and poor oral health–related behaviors. As a result, interdisciplinary healthcare teams have a critical role in informing diabetic individuals about their heightened susceptibility to oral diseases and fostering a comprehensive integration of systemic and oral health care. Oral health education by diabetes care providers and referral to dentists was related to having proper oral health behaviours in patients. [10, 11]. Since many diabetic patients remain unaware of their elevated risk for oral complications, collaboration between medical and dental professionals is essential to implement public education campaigns that increase awareness of the oral manifestations of diabetes and their impact on overall oral health [12-14].

Aim of study was to evaluate the relationship between glycemic control and the presence of chronic apical periodontitis CAP in endodontically treated teeth among patients with type 2 diabetes, by comparing with those of a non-diabetic control group and analyzing differences according to sex and place of residence.

MATERIALS AND METHOD

This retrospective study investigated endodontic pathology of a group of 90 patients (mean age was 60.13 +/-11.42 years; gender: 49 men, 41 women; residence: 63-urban, 27-rural) diagnosed with diabetes type 2 hospitalized at "St. Spiridon" Hospital in Iaşi, in the Department of Oral and Maxillofacial Surgery. This study respected the principles of Declaration of Helsinki and received approval from the Ethics Department of the University of Medicine and Pharmacy "Grigore T. Popa" Iași (Romania). All patients participating in the study signed a consent form approved by the ethics committee of U.M.F. "Grigore T. Popa" Iaşi. Diabetes type 2 was diagnosed according to the criteria issued by the American Diabetes Association [15]. All subjects, were compliant with the medication prescribed by their diabetologist, were submitted to tests of

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fasting blood glucose and glycated hemoglobin (HbA1c). A dental specialist assessed the oral cavity status by clinical examen (visual-tactile) and radiological examination. Digital panoramic radiographs were taken in order to assess the endodontic and periapical condition of the dentition of the patients. The imaging was carried out by two radiology technicians using a digital orthopantomograph (CRANEX D CEPH, DC-type generator, operating frequency 40 kHz, SOREDEX, Tuusula, Finland). A structured oral-dental examination was performed for each patient, including the following: the number and location of endodontically treated teeth without CAP; the number and location of endodontically treated teeth with CAP. Periapical status was assessed using the PAI proposed by Ørstavik [16].The assessment and classification of teeth for the study groups were performed by two dental radiology experts, according to the PAI scoring system. Before the evaluation, both examiners were calibrated by evaluating 50 radiographs of healthy teeth, teeth with CAP (PAI scores 2–5), and root-treated teeth with or without CAP. Reproducibility was confirmed by reclassifying PAI scores 3 months after the baseline evaluation. Prior to the second group of assessments, the two observers were again calibrated using an independent set of 100 radiographic images. A value of PAI > 1 was considered indicative of periapical pathology. Prevalence and distribution of chronic periapical lesions was analysed both globally and related to socio-demographic parameters in diabetic and non-diabetic patients. All data were recorded using Microsoft Excel (Microsoft Corporation, Redmond, WA, USA). Statistical analysis was performed using SPSS version 20.0. In descriptive statistics, frequency distributions were calculated for the qualitative variables, and descriptive parameters were computed for the quantitative variables.

RESULTS

The glycemia distribution differed markedly between the non-diabetic and diabetic groups. In the non-diabetic group, glycemia values ranged from approximately 70 to 110 mg/dL, with a mean glycemia of 90.72 mg/dL (SD 9.825). The diabetic group exhibited a much broader and more asymmetric distribution of glycemia values, ranging from approximately 100 to over 500 mg/dL. The mean glycemia was substantially higher, at 201.44 mg/dL (SD 81.227).

Table 1. Glycemia range and mean values in diabetic and non-diabetic patients

Group	Glycemia Range (mg/dL)	Mean Glycemia (mg/dL)	Standard Deviation
Non-diabetic	70–110	90.72	9.825
Diabetic	100–500+	201.44	81.227

In the non-diabetic group, the mean glycemia values varied slightly according to the number of endodontically treated teeth without chronic apical periodontitis (CAP). For the total group, the mean glycemia decreased gradually from 93.33

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mg/dL in individuals with 0–1 teeth without CAP to 89 mg/dL in those with 4 or more. Among females, the values ranged from 93 mg/dL (0–1 teeth without CAP) to 91.5 mg/dL (4 or more teeth). In males, a more noticeable decrease was observed, with glycemia values dropping from 93.5 mg/dL (0–1 teeth without CAP) to 86.5 mg/dL (4 or more teeth). In terms of residence, rural individuals showed mean glycemia values of 93.5 mg/dL for 0–1 teeth without CAP, decreasing to 83.5 mg/dL in patients with 2–3 teeth, and slightly increasing again to 92.5 mg/dL for those with 4 or more teeth without CAP. Urban residents started with a higher mean glycemia of 96.14 mg/dL for 0–1 teeth without CAP, which gradually declined to 85.5 mg/dL in the group with 4 or more teeth without CAP (Fig.1). In diabetic group, the mean glycemia values showed a marked increase with a higher number of endodontically treated teeth without chronic apical periodontitis (CAP). For the total group, mean glycemia increased from 182.71 mg/dL in individuals with 0–1 teeth without CAP to 330 mg/dL in those with 4 or more teeth without CAP. Among females, glycemia ranged from 207.47 mg/dL (0–1 teeth without CAP) to 216.26 mg/dL (2–3 teeth), rising steeply to 382 mg/dL (≥ 4 teeth). In males, the values increased from 159.5 mg/dL (0–1 teeth without CAP) to 226 mg/dL (≥ 4 teeth). In rural, mean glycemia increased from 192.13 mg/dL (0–1 teeth without CAP) to 204.17 mg/dL (≥ 4). In contrast, urban residents displayed a more pronounced increase in glycemia values, from 179.43 mg/dL (0–1 teeth without CAP) to 330 mg/dL (≥ 4) (Fig.2).

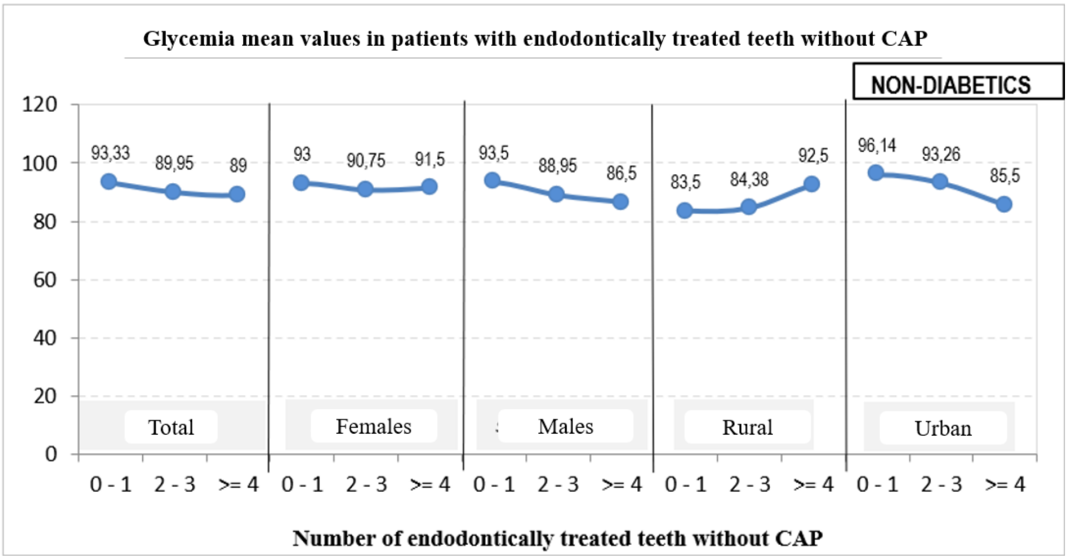

Fig.1. Mean glycemia values in the non-diabetic patient group, compared by the number of root-filled teeth without CAP

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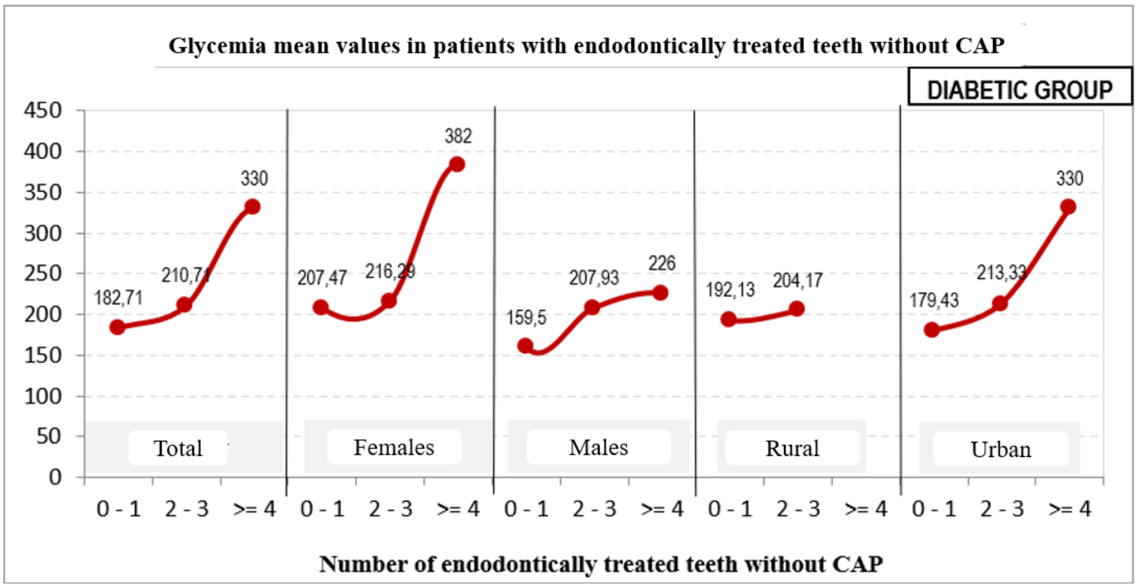

Fig.2. Mean glycemia values in the diabetic patient group, compared by the number of root-filled teeth without CAP

In the non-diabetic group, the mean glycemia values increased progressively with the number of endodontically treated teeth presenting with chronic apical periodontitis (CAP). For the total group, mean glycemia rose from 86.57 mg/dL in individuals with 0–1 teeth with CAP to 102.44 mg/dL in those with 4 or more. Among females, glycemia increased from 84.67 mg/dL (0–1 teeth with CAP) to 91.37 mg/dL (2–3 teeth), reaching 104 mg/dL in the group with 4 or more affected teeth. In males, the values followed a similar trend, starting at 88 mg/dL for 0–1 teeth with CAP and increasing to 104 mg/dL for 4 or more. In rural residents, mean glycemia values began at 77.8 mg/dL (0–1 teeth with CAP), rose to 90.67 mg/dL (2–3 teeth), and peaked at 99.33 mg/dL in those with 4 or more. Among urban residents, glycemia remained between 91.44 mg/dLand 91.3 mg/dL for up to 3 teeth with CAP, but increased to 104.86 mg/dL in the group with ≥4 teeth with CAP (Fig.3).

In the diabetic group, mean glycemia values showed a clear upward trend in relation to the number of endodontically treated teeth with chronic apical periodontitis (CAP). For the total group, glycemia increased from 165.22 mg/dL in individuals with 0–1 teeth with CAP to 236.71 mg/dL in those with 4 or more. Among females, mean glycemia values rose from 164 mg/dL (0–1 teeth with CAP) to 213.43 mg/dL (2–3 teeth), and peaked at 259.67 mg/dL in individuals with 4 or more affected teeth. In males, glycemia values initially declined from 165.83 mg/dL (0–1 teeth with CAP) to 158.46 mg/dL (2–3 teeth), then increased to 219.5 mg/dL in the group with 4 or more. Among rural residents, mean glycemia rose steadily from 173 mg/dL (0–1 teeth with CAP) to 257 mg/dL in those with 4 or more. In urban residents, values increased from 192.47 mg/dL (0–1 teeth with CAP) to 231.94 mg/dL (4 or more teeth with CAP) (Fig.4).

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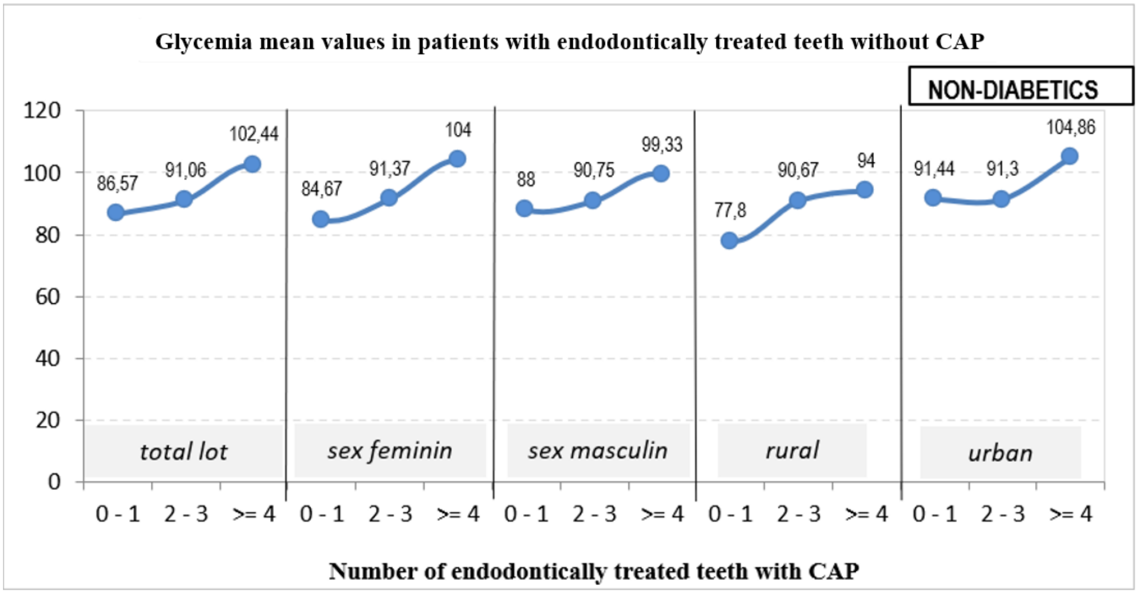

Fig.3. Mean glycemia values in the non-diabetic patient group, compared by the number of root-filled teeth with CA

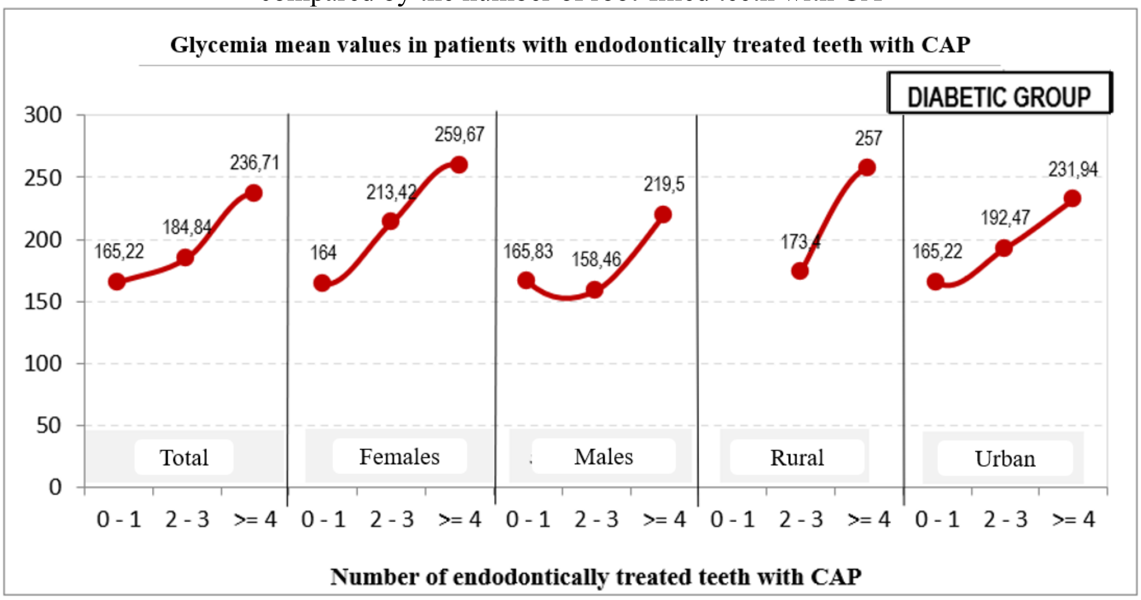

Fig.4. Mean glycemia values in the diabetic patient group, compared by the number of root-filled teeth with CAP

DISCUSSIONS

Chronic apical periodontitis is a long-standing inflammation of the periapical tissues, mainly caused by continuous microbial assault of the root canal system favoured by various risk factors such as improper endodontic re-treatments, coronal microleakage, poor hygiene of the oral cavity, untreated carious teeth, periodontal disease, dental trauma, missed canals, over-instrumentation and overfilling of the root canals, aging, or tobacco smoking [17-20]. Thus, the objective of endodontic therapy is to remove bacterial antigens and toxins ability of the periapical tissues to heal [21]. The systemic conditions of the host (i.e. diabetes) heavily impact the initiation and progression of the disease, as well as its ability to heal [22, 23]. In this context, we aimed to assess the prevalence and distribution of endodontic pathology

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among patients with diabetes when compared with non-diabetes patients.

Our findings concerning the comparison of the mean nodal values of glycemia in both groups (diabetics vs. non-diabetics) suggest the groups are quite separated from each other concerning glycemic status (regarding central tendency and variability), which fits the expected physiological differences among non-diabetics and diabetics. In non-diabetics, there was a small but consistent trend of lower glycemia values with increasing number of endodontically treated teeth in the absence of CAP, especially in men and urban inhabitants. In the diabetic group, our findings showed that there is an evident trend of increase in the mean glycemic values in patients with endodontically treated teeth without CAP, especially in women and those living in urban areas, which suggests an association between the glycemic level and the periapical healing in this population. Regarding the non-diabetic patients with endodontically treated teeth and CAP, our findings indicate a moderate increment of the mean glycemia values with a rising number of root canal filled CAP, especially in rural and male subgroups. Our findings demonstrate a general tendency to higher glycemia values associated with higher number of root-filled teeth with CAP, mainly among females and rural patients, a fact indicating a possible association between poor glycemic control and presence of periapical pathology in this population.

Although several studies have reported a significant association between periapical lesions and diabetes mellitus, this relationship does not inherently imply causation; establishing a causal link requires fulfilling specific criteria including the exclusion of bias and demonstrating that diabetes contributes to the development or persistence of periapical pathology and that improved glycemic control reduces its prevalence [24]. Under certain systemic conditions like diabetes, the host may be more susceptible to infection or exhibit impaired healing of the periapical tissues, which explain the relatively high number of failures among some endodontic cases [25]. A research group reviewed evidence on the association between diabetes and chronic CAP in root-filled teeth, reporting that diabetic patients had a 1.42-fold higher risk of CAP compared to non-diabetics in univariate and multivariate analyses [7]. A meta-analysis demonstrated that diabetic patients showed a significantly higher risk of extraction of endodontically treated teeth, with an odds ratio of 2.44 compared to non-diabetic individuals [26]. In a 12-month follow-up study of endodontically treated patients, the diabetic cohort had significantly less periapical healing (43%) than the non-diabetic control group over the same period [27]. The prevalence of periapical radiolucencies is significantly higher after endodontic treatment in patients with poor glycemic control when compared with patients with normal levels of blood glucose [28]. A research group also concluded that patients with poor glycemic control were more likely to experience persistent apical periodontitis after endodontic treatment [29-30]. Females and rural residence influence significantly the increase of periapical lesions prevalence among patients with high level of blood glucose and HbA1c levels [29]. However, another research proved that age and gender do not

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influence significantly the CAP prevalence in diabetic and non-diabetic patients, despite almost double proportion of root-filled teeth with CAP in diabetics compared to non-diabetics [30]. Among patients with elevated plasma glucose levels (90–110 mg/dL), 48% exhibited periapical radiolucencies, whereas 74% of those with lower glycemic values (70–89 mg/dL) showed these lesions [31].

CONCLUSIONS

The glycemia distribution differed significantly between groups, with non-diabetics showing a narrow, near-normal range, while diabetics had substantially higher and more variable values, indicating poorer metabolic control. In individuals without CAP, glycemia remained relatively stable or slightly decreased in non-diabetics, whereas in diabetics it increased markedly with the number of treated teeth. For teeth with CAP, both groups showed increasing glycemia with more affected teeth, but the rise was much greater in diabetics compared to non-diabetics, indicating a stronger association between poor glycemic control and persistent lesions. Female and urban diabetic patients showed the steepest increases in glycemia as the number of treated teeth increased, while male and rural diabetics had more moderate increases. Non-diabetic individuals in all subgroups maintained relatively stable glycemia levels, regardless of sex or residence.

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