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Original Article

Oral health in people with diabetes and chronic kidney disease: A series of cases

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Abstract

Diabetes mellitus and chronic kidney disease have become increasingly prevalent over the last decade. They are usually related to a poor oral health condition, particularly to a high prevalence of periodontal disease. This case series includes 26 patients suffering from diabetes mellitus and chronic kidney disease. The clinical examinations were performed by the same examiner using a dental mirror and a rounded-tip periodontal probe. Demographical data was collected by interview. Clinical data concerning the number of functional teeth, periodontal parameters, and hygiene index were recorded in a special assessment form. Radiological data were also used for periodontal assessment. The mean age of the group was 63.11±9.5 years. Periodontal disease was present in all dentate patients. More than half of the dentate patients had unsatisfactory oral hygiene. Patients suffering from both diabetes and chronic kidney disease presented a high prevalence of periodontitis, with more severe forms and poor oral hygiene.

Keywords: diabetes mellitus, chronic kidney disease, oral health, oral hygiene.

Introduction

Diabetes mellitus (DM) and chronic kidney disease (CKD) are chronic diseases with increasing prevalence worldwide that cause multiple complications within the human body and impose a great burden on the health systems [1, 2]. Moreover, diabetes is reported to be one of the most frequent causes of CKD in the Western world [2, 3]. According to the International Diabetes Federation, 10.5% of the adult population worldwide has diabetes, almost 90% of which are diagnosed with type 2 diabetes [4]. A report regarding the epidemiology of kidney disease from 2022 estimated that more than 10% of the world population has CKD [5].

The relationship between DM and CKD has been reported in an increasing number of studies over the past decade. Research has shown that diabetes can lead to CKD because of the long-term destruction of blood vessels in the kidneys [6]. It has been reported that almost 50% of patients with type 2 diabetes and 33% of patients with type 1 diabetes will also develop CKD [6, 7], which, in this case, is also known as diabetic kidney disease (DKD). Alternatively, some studies explained that CKD can lead to DM, as insulin production can be affected by the buildup of waste products in the body due to kidney malfunction [8].

The association of both diseases has greater medical implications for the patient, leading to increased

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mortality. Studies report that patients with CKD and diabetes have higher mortality rates than those with no diabetes [9, 10]. A fact sheet issued by the World Health Organization reported that an estimated number of 2 million deaths were caused by diabetes and kidney disease induced by diabetes in 2019 [11].

Diabetes and CKD also have a negative influence on oral health. Some induced oral manifestations, namely *xerostomia, candidiasis and periodontal disease*, are common for both diseases. Findings in the last two decades have shown that periodontal disease (PD) is more prevalent in CKD patients, as well, and also has a negative influence on its evolution and severity, including increased mortality risk [12]. Research comparing patients with CKD and diabetes to patients with CKD and no diabetes showed that the first group was at higher risk of developing systemic health complications and showed increased oral health problems [13]. A similar study involving patients with terminal CKD on hemodialysis treatment showed that having diabetes as a comorbidity increased the prevalence of oral health problems [14]. Both studies suggest increasing patient awareness regarding oral health treatment and preventive strategies [13, 14].

Our study presents the oral health status of a series of patients with DM and CKD cases.

Material and methods

Study design and patients

The study design is a series of individuals presenting both DM and CKD cases. The subjects were selected from a larger cohort of 217 patients from two hemodialysis centers in Bucharest – Fresenius Nephrocare Dialysis Centre and IHS Sf. Pantelimon Dialysis Centre enrolled in a study that explored the link between CKD and oral health status. The investigation revealed that 12% of these patients (n=26) also presented with DM, and they represent the individuals in this series of cases.

The study was approved by the Ethical Committee of Carol Davila University (04/01.01.2013), and all patients involved in this study signed an informed consent form.

Laboratory, anthropometric and clinical data collection

Demographical and clinical data was gathered by a single person through an interview and an oral examination while the patient underwent dialysis. Oral clinical data included the plaque index according to Silness and Loe [15], the total number of functional teeth, the periodontal pocket depth (PPD), and the clinical attachment level (CAL). The periodontal probe recommended by the World Health Organization (WHO) was used to make the periodontal measurements.

The Silness and Loe plaque index (PI) was used to assess the amount of dental plaque, which directly relates to the quality of oral hygiene – dental plaque is considered the causal factor for caries and periodontal disease. The final values for this index vary from 0–3. The values of the plaque index are interpreted as follows: 0 – excellent PI, 0.1–0.9 – good PI, 1–1.9 – satisfactory PI, and 2–3 – unsatisfactory PI.

The degree of severity for the periodontal disease (PD) was classified in accordance to the system proposed by the Centre for Disease Control (CDC) and the American Academy of Periodontology in 2003 [16]: severe periodontal disease – 2 or more approximal sites with CAL≥6 mm and 1 or more approximal sites with PPD≥5 mm, on different teeth; moderate periodontal disease – 2 or more approximal sites with CAL≥4 mm or 2 or more approximal sites with PPD≥5, on different teeth.

Statistical analysis

The sample was analyzed using the 16.0 version of the SPSS (trial version).

Results

The mean age of the group was 63.11±9.5 years, ranging from 43–85 years old, of which 11 were female.

Considering the number of functional teeth (teeth that can receive a conservative treatment and, if necessary, used for prosthetic purposes), 10 individuals were edentate or had less than 5 functional teeth (38.5%), 7 had less than 14 teeth left (26.9%), and 10 had 17 or more functional teeth (38.5%). Of the 16 dentate patients, 7 presented unsatisfactory oral hygiene (PI values between 2–3), and 8 had satisfactory oral hygiene (PI values ranging between 1–1.9).

The presence of periodontal disease was assessed for the 16 dentate patients. All 16 individuals presented PD in moderate or severe form, with 10 patients (62.5%) manifesting the disease in a severe form.

The patients' oral radiographic exams revealed many horizontal and vertical (periodontal pocket) bone

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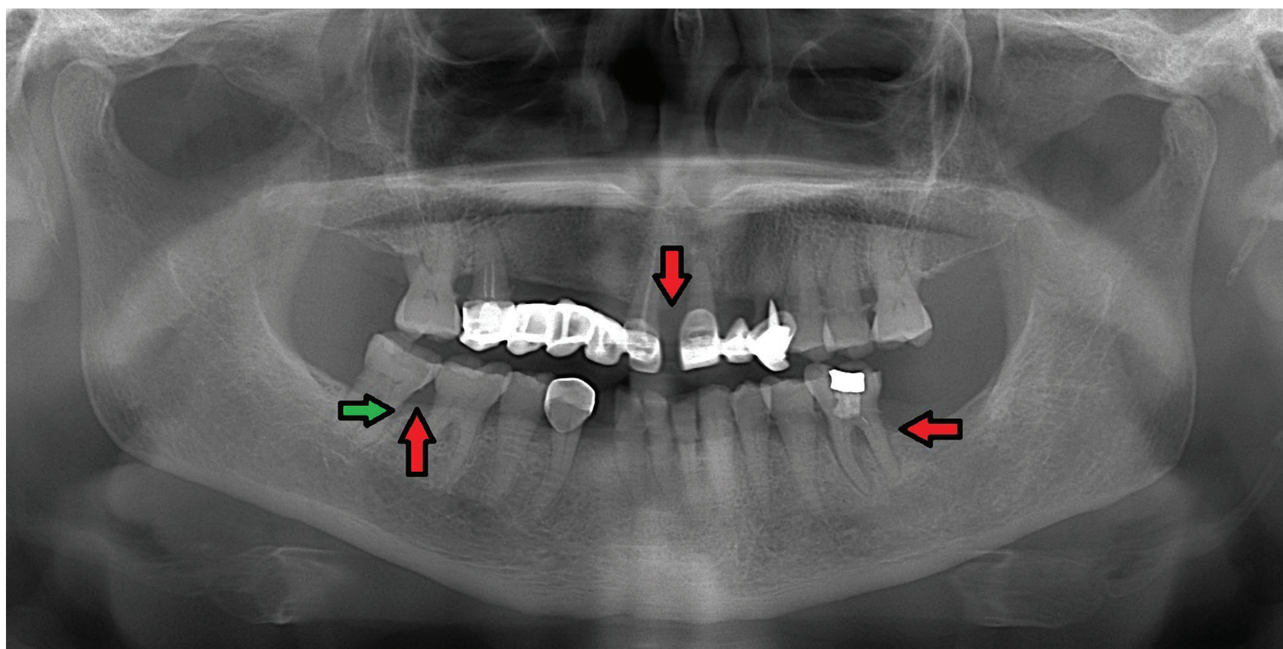

Figure 1: Orthopantomography (OPG) x-ray of a patient with DM and CKD. Bone resorptions are marked with arrows: horizontal (red color) and vertical – periodontal pocket (green color).

resorptions due to periodontitis (Figures 1–3). Moreover, 10 patients (38%) of the group lost their teeth due to periodontitis (Figure 4).

Discussion

All dentate patients selected in our study (suffering from both DM and CKD) presented the main clinical signs related to periodontitis, such as bone resorption and periodontal pockets, and more than 60% had a severe form of the disease. Because tooth loss is considered a complication of periodontal disease [17, 18], one can consider that the edentate patients from this study suffered from periodontal disease in the past. Considering this, all patients from our study presented periodontal disease.

Patients with DM suffer from periodontitis more often, and their clinical forms are, in general, more severe [11, 13, 14]. Our study showed the same increased

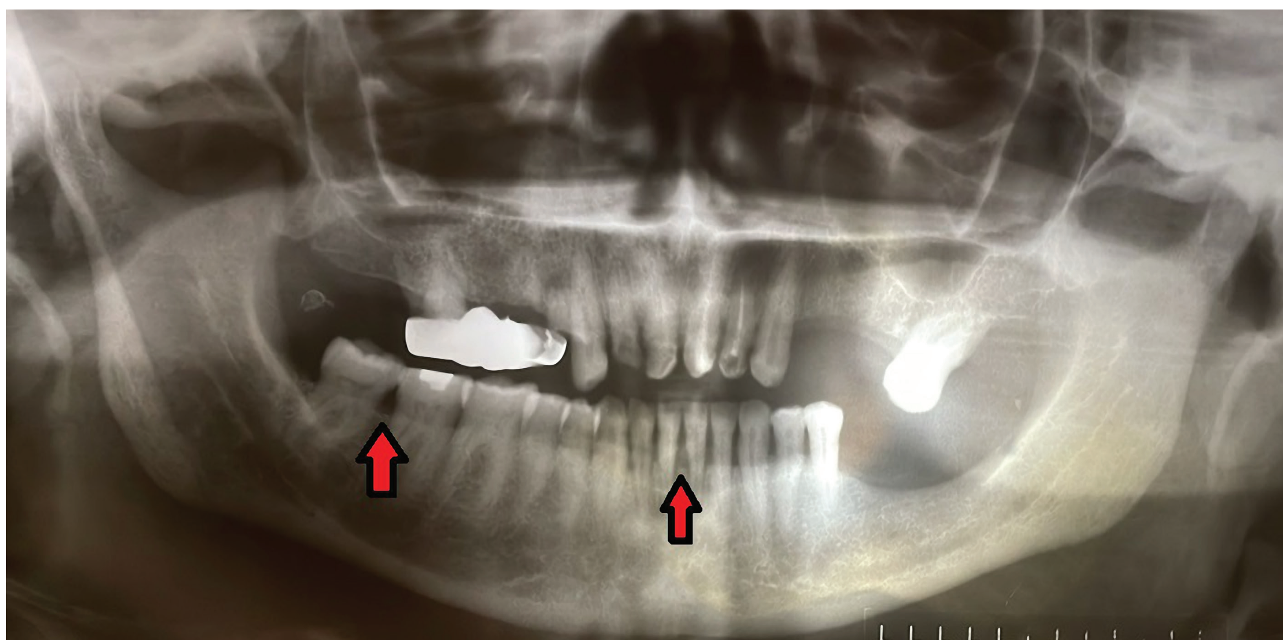

Figure 2: OPG x-ray of a patient with DM and CKD. Bone resorptions are marked with arrows.

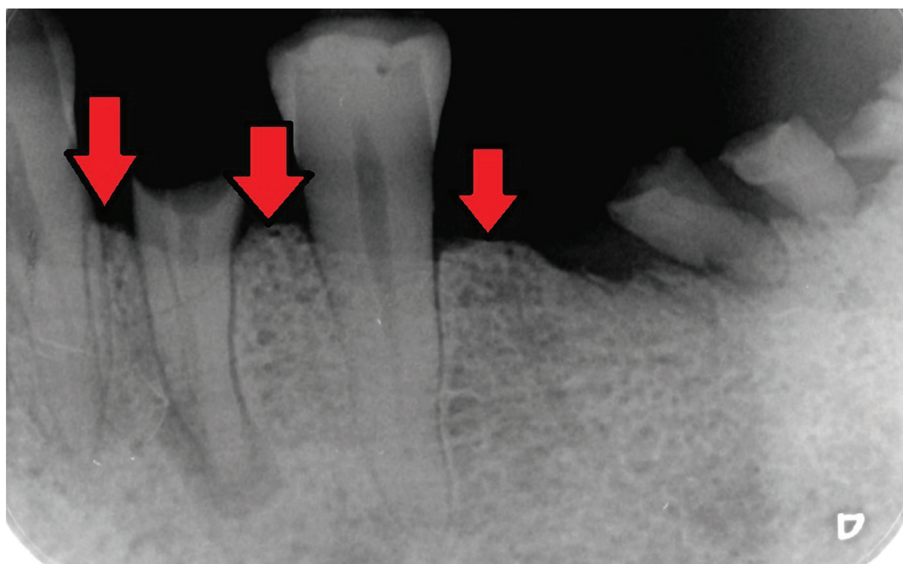

Figure 3: Dental x-ray of a patient with DM and CKD. Bone resorptions are marked with arrows.

prevalence of severe periodontitis in such patients. DM can lead to periodontitis due to a lot of pathological processes in the periodontal tissues such as local acidosis and other cellular mechanisms disturbers (poor energy regulation, membrane changes, mitochondrial dysfunction, insufficient elimination of debris), capillary fragility, neuritis, decreasing of the local immune response and increasing the local risk for inflammation and infection [17–19]. Moreover, the link between DM and periodontal diseases is a two-way relationship, and periodontitis can influence the general condition of the diabetes patient as well. For example, severe forms of periodontitis are related to a high risk of developing DM, poor glycemic control, and increased mortality due to DM [20, 21].

On the other hand, patients suffering from CKD presented, in general, more severe forms of periodontitis, as well as a higher percent of deep periodontal pockets [21, 22]. Moreover, CKD usually leads to poor salivary secretion and xerostomia, which may influence local immune response and increase the risk of periodontitis.

The findings in our study are similar to the results of studies and meta-analyses investigating oral health in patients with both DM and CKD undergoing dialysis treatment [23–25], which have shown an increased prevalence of periodontitis and poor oral hygiene for these individuals.

As dental plaque is considered the main causal factor for periodontal disease [17, 18], poor oral hygiene is

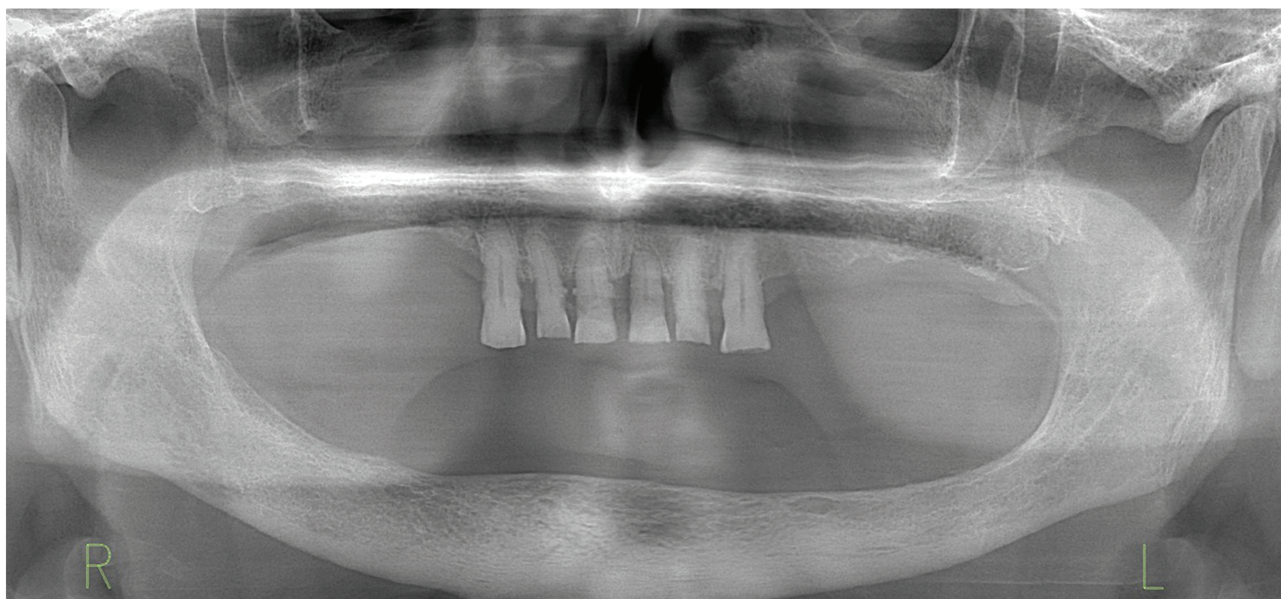

Figure 4: OPG x-ray of a patient with DM and CKD. The patient lost his teeth due to periodontitis.

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considered a risk factor for both the onset and progression of periodontitis. In this regard, preventive and therapeutic strategies regarding the control of periodontal disease and education for correct oral hygiene should be considered for these patients [23–25]. As most of the individuals in our study had precarious oral hygiene, in addition to the high prevalence of severe periodontal disease, the need for oral prophylaxis, dental treatment, and education regarding correct habits for preventing periodontal disease should be considered for the individual in the group.

Conclusion

Periodontal disease in a severe form was highly prevalent in this group. Edentulism, or a reduced number of functional teeth secondary to periodontal disease, was present in over a third of the patients in this case series. Poor oral hygiene had an increased prevalence in dentate patients. These findings suggest the need for education regarding the prevention of periodontal disease in patients suffering from both diabetes mellitus and chronic kidney disease.

Conflict of interest

The authors declare no conflict of interest.

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