DENTAL MEDICINE **ORIGINAL PAPERS**

LONGITUDINAL CLINICAL STUDY ON THE PREVALENCE AND RISK FACTORS OF ROOT CARIES IN ELDERLY PATIENTS

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LONGITUDINAL CLINICAL STUDY ON THE PREVALENCE AND RISK FACTORS OF ROOT CARIES IN ELDERLY PATIENTS (Abstract): Dental caries remains one of the most common oral diseases, with a multifactorial etiology involving biological, behavioral, socio-economic, and age-related factors. In elderly patients, physiological changes, systemic diseases, polypharmacy, reduced salivary flow, and gingival recession increase susceptibility to root caries. The **aim** of this study was to evaluate the prevalence of coronal and root caries across different age groups and to identify the etiological factors involved in root caries by comparing caries experience and individual cariogenic risk in adult and geriatric patients. **Materials and methods:** The study included 293 patients examined at the Clinical Teaching Base of the Faculty of Dental Medicine Iași between 2022 and 2026. Clinical assessment included the evaluation of coronal and root caries, gingival recession, and DMFT index. **Results:** Socio-economic factors, systemic diseases, and medication were recorded using a standardized questionnaire. Cariogenic risk was assessed by determining salivary levels of *Streptococcus mutans* and Lactobacilli, resting and stimulated salivary flow, salivary buffer capacity, and caries susceptibility using the modified Snyder test. Statistical analysis was performed using Chi-square and Kruskal-Wallis tests, with the significance level set at $p < 0.05$. Coronal caries showed the highest prevalence in the 71-80-year age group, followed by the 51-60-years group. Root caries was also most frequent in the 71-80-years group, followed by patients over 80 years. DMFT values increased with age, mainly due to the "M" component, reflecting cumulative tooth loss. Systemic diseases, xerostomia-inducing medication, gingival recession, reduced salivary parameters, and increased microbial load were associated with higher cariogenic risk. **Conclusions:** Root caries in elderly patients has a multifactorial etiology, influenced by age-related oral changes, systemic conditions, medication, salivary dysfunction, gingival recession, and cariogenic microorganisms. These findings support the need for individualized preventive and therapeutic strategies in geriatric dental care. **Keywords:** ROOT CARIES, ELDERLY PATIENTS, GERIATRIC DENTISTRY, DMFT INDEX, CARIOGENIC RISK.

INTRODUCTION

Currently, across all medical fields, the emphasis is placed on prevention, aiming to limit disease onset or progression to advanced stages. In dentistry, dental caries remains the most common condition, characterized by high prevalence and a significant impact on patients' quality of life (1, 2). Although often perceived as a minor condition, dental caries is now recognized as a complex, multifactorial process resulting from the interaction of biological, behavioral, and socio-economic factors (3, 4). Recent studies have shown that the development of dental caries is influenced by factors such as high sugar consumption, poor oral hygiene, reduced salivary flow, insufficient fluoride exposure, and low socio-economic status. In the geriatric population, these factors are amplified by physiological changes associated with aging, including decreased salivary secretion, alterations in salivary composition, reduced self-care ability, and the frequent use of multiple medications (5, 6). Furthermore, age-related systemic conditions, such as diabetes mellitus and cardiovascular diseases, may indirectly affect oral health, increasing susceptibility to caries, particularly at the root surface level. From a microbiological perspective, *Streptococcus mutans* and Lactobacilli play a key role in the etiology of dental caries, with their presence and levels being directly correlated with caries incidence and the intake of fermentable carbohydrates (7,8). Quantitative assessment of these microorganisms is therefore useful not only for evaluating cariogenic risk but also for estimating dietary carbohydrate intake. In addition to these species, other bacteria have been implicated in the carious process, including *Veillonella*, non-mutans oral streptococci (*S. mitis, S. oralis, S. gordonii*), and Actinomyces species, which are capable of acid production at low pH levels (9, 10). The association between these microorganisms and dental caries is closely related to carbohydrate consumption, which is essential for the initiation and progression of the carious process. Levels of *Lactobacillus* and *Streptococcus mutans* may vary significantly even following short-term dietary changes (11, 12). The metabolism of dietary carbohydrates by dental plaque leads to the production of organic acids, which cause demineralization of dental structures (13, 14). This process is particularly relevant at the root level, where cementum and dentin are less resistant to acid attack compared to enamel. Repeated exposure to an acidic environment alters the oral ecosystem, favoring the selection and proliferation of acidogenic and aciduric bacteria (15, 16). While the effects of acid stress on the oral microbiota have been extensively studied, the role of nutrient deprivation has received less attention (17, 18). Studies suggest that under conditions of reduced dietary intake, certain species such as *Streptococcus oralis* and *S. mitis* may proliferate by utilizing salivary glycoproteins as an energy source (19). In this context, the management of geriatric patients requires a comprehensive approach that integrates local, systemic, and behavioral factors. Monitoring these variables is essential for understanding the prevalence and risk factors associated with root caries, contributing to the development of effective preventive and therapeutic strategies tailored to this patient population (20).

The aim of this study was to evaluate the prevalence of coronal and root caries across different age groups and to identify the etiological factors involved in root caries by comparing the degree of caries experience and the individual cariogenic risk between adult and geriatric patients.

MATERIALS AND METHODS

The study was conducted on a sample of 293 patients who attended the Clinical Teaching Base of the Faculty of Dental Medicine in Iași between 2022 and 2026. All participants were included in the study after providing written informed consent. Clinical examination was performed under standardized conditions, in the dental chair, ensuring adequate illumination and isolation of the operating field. Prior to evaluation, professional oral hygiene procedures were carried out, including manual or ultrasonic scaling followed by professional tooth brushing. The clinical assessment focused on the identification of coronal and root caries lesions, as well as the evaluation of gingival recession. Caries experience was quantified using the DMFT index. For the assessment of cariogenic risk, patients completed a standardized questionnaire that included data regarding socio-economic status, educational level, presence of systemic diseases, and associated medication, with potential impact on the carious process, particularly through alterations in salivary flow or carbohydrate content.

The analysis of local etiological factors included the determination of the Silness and Löe plaque index, evaluation of salivary microbiota, and assessment of salivary parameters. Bacterial load was assessed by determining the levels of *Streptococcus mutans* (Dentocult SM method) and Lactobacilli (Dentocult LB), using standardized microbiological tests.

Salivary parameters were evaluated by measuring resting and stimulated salivary flow rates, as well as buffer capacity, using the Dentobuff method. Salivary flow values were expressed in ml/min, while buffer capacity was assessed colorimetric ally according to the manufacturer's scale. Individual susceptibility to dental caries was determined using the modified Snyder colorimetric test (Arthur Alban), which evaluates the acidogenic activity of oral bacterial flora. The interpretation of results was based on color changes of the culture medium, reflecting acid production levels and, implicitly, cariogenic risk. By correlating clinical, microbiological, and salivary data, the study aimed to evaluate the prevalence of caries lesions and to identify the risk factors involved in the development and progression of dental caries, with a particular focus on root caries in elderly patients.

Statistical analysis was performed in *SPSS version 29.0.* The qualitative data were reported as absolute frequencies and percentages, and the quantitative data were reported as averages and standard deviations. The associations between qualitative data were investigated using the Chi-squared test. The differences between quantitative data in multiple samples were investigated using the Kruskal-Wallis test, after checking the values distribution condition of normality (using the Shapiro-Wilk test). The values of $p < 0.05$ were evaluated as statistically significant, and the values of $p < 0.01$ were evaluated as statistically highly significant.

RESULTS

In order to achieve the objectives of the study, the collected data were statistically analyzed and presented in tables and graphical representations to highlight the distribution of the study group and the prevalence of carious lesions according to the investigated parameters. The study group was characterized from a demographic perspective (gender and age), followed by the analysis of the distribution of coronal and root caries lesions across different age groups. Additionally, the relationship between demographic variables and the studied parameters was evaluated to identify potential statistically significant correlations.

The gender distribution of the study group (tab. I) showed a relatively balanced proportion between male (50.5%) and female patients (49.5%). The age distribution (tab. I) revealed a predominance of the 61-70-year age group (51.9%), followed by the 51-60-year (17.7%), 71-80-year (17.1%), and over 80-year (13.3%) groups.

TABLE I.

The demographical features of the sample

		n	%
Gender	male	148	50.5
	female	145	49.5
Age group	51 - 60 ys	52	17.7
	61 - 70 ys	152	51.9
	71 - 80 ys	50	17.1
	over 80 ys	39	13.3
Total		293	100.0

The comparative distribution on genders by age groups did not reveal statistically significant differences (Chi-square test, p = 0.165) (fig. 1). However, a predominance of male patients was observed in the 51-60 and 61-70 age groups, a relatively balanced distribution in the 71-80 group, and a predominance of female patients in the over 80 group.

Regarding the prevalence of coronal caries (tab. 2), the highest values were recorded in the 71-80-year age group (20%), followed by the 51-60-years group (19.23%), the over 80 years group (12.8%), and the 61-70-year group (8.5%). The prevalence of root caries was highest in the 71-80-years age group (10%), followed by patients over 80 years (5.1%), the 51-60-years group (3.8%), and the 61-70-years group (3.2%).

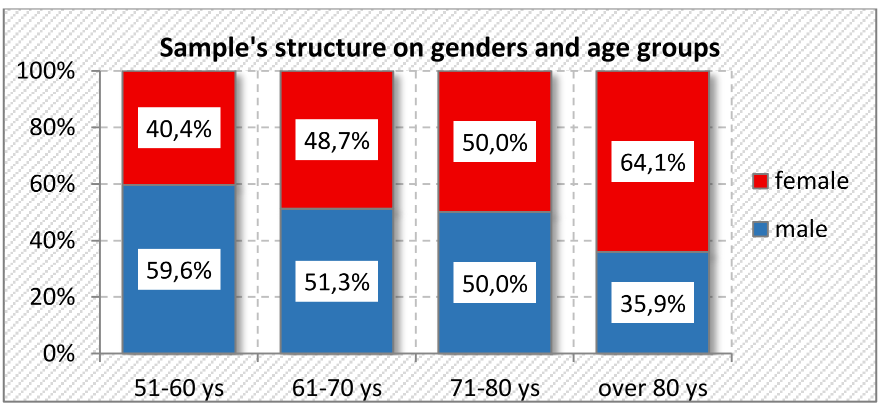

Fig. 1. Patients' distribution by genders and age groups

TABLE II.
The caries distribution by age groups

	Total		Age group								p-value†
			51-60 yrs.		61-70 yrs.		71-80 yrs.		over 80 yrs.		
	n	%	n	%	n	%	n	%	n	%	
Caries	38	12.9	10	19.2	13	8.5	10	20.0	5	12.8	0.085
Root caries	14	4.7	2	3.8	5	3.2	5	10.0	2	5.1	0.279

†Chi-squared test

Following the analysis of caries prevalence, the study further evaluated the degree of caries involvement and identified the factors contributing to the development of root caries. In this context, clinical indicators such as the DMFT index, the presence of gingival recession, socio-economic factors, systemic diseases, associated medication, plaque index, and salivary microbiological parameters were comparatively analyzed.

Comparison of the level of caries involvement

The mean number of carious teeth varied according to age group, with the highest values recorded in patients aged 51-60 years (3.75 teeth), followed by those aged 61-70 years (2.91), 71-80 years (2.3), and over 80 years (1.72) (tab. III). The differences between age groups were statistically highly significant.

Enamel caries lesions showed the highest mean values in the 71-80-year age group (0.44), followed by the 51-60 (0.19), 61-70 (0.14), and over 80 (0.08) age groups. However, the differences between groups were not statistically significant.

For dentin caries lesions, the highest values were observed in the over 80 years age group (1.41), followed by the 51-60-year age group (1.35), 61-70 (0.97), and 71-80 (0.48), the differences between groups being again statistically highly significant.

TABLE III.
The level of caries by age groups

	Age group				Total M ± SD	p-value†
	51-60 yrs. M ± SD	61-70 yrs. M ± SD	71-80 yrs. M ± SD	over 80 yrs. M ± SD		
No. of carious teeth	3.75 ± 2.970	2.91 ± 2.969	2.30 ± 2.735	1.72 ± 1.820	2.80 ± 2.855	0.004**
No. of enamel caries	0.19 ± 0.445	0.14 ± 0.431	0.44 ± 1.514	0.08 ± 0.270	0.19 ± 0.734	0.513
No. of dentin caries lesions	1.35 ± 1.426	0.97 ± 1.617	0.48 ± 1.446	1.41 ± 1.712	1 .01 ± 1.591	<0.001**
No. of root caries lesions - located at cementum level	0.12 ± 0.379	0.64 ± 1.088	1.06 ± 1.476	0.56 ± 0.754	0.61 ± 1.075	<0.001**

†Kruskal-Wallis test, **p < 0.01 Statistically highly significant

Root caries lesions, located at the cementum level, were more frequent in patients aged 71-80 years (1.06), followed by those aged 61-70 years (0.64), over 80 years (0.56), and 51-60 years (0.12). These differences were also statistically highly significant.

The mean number of filled teeth was highest in the 51-60-year age group (2.98), followed by the 61-70 (1.18), over 80 (1.08), and 71-80 (0.32) groups (fig. 2). This distribution was also statistically significant ($p < 0.001$).

The DMFT index showed higher values in patients over 80 years and in those aged 71-80 years compared to the 51-60 and 61-70 age groups (fig. 3). These findings can be explained by an increase in the "M" component of the index, reflecting a higher number of missing teeth due to complications of dental caries. Additionally, patients from rural areas presented higher DMFT values compared to those from urban areas, regardless of age group.

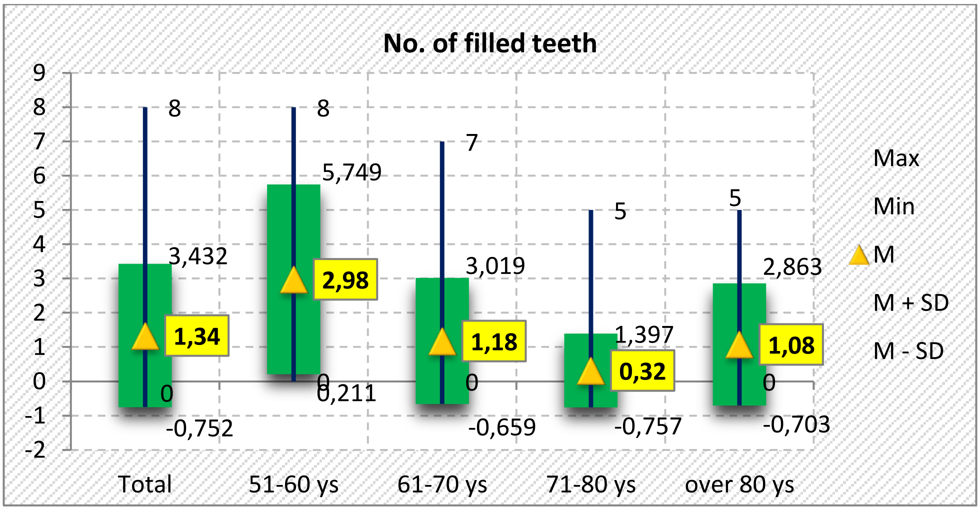

Fig. 2. Distribution of filled teeth by age group

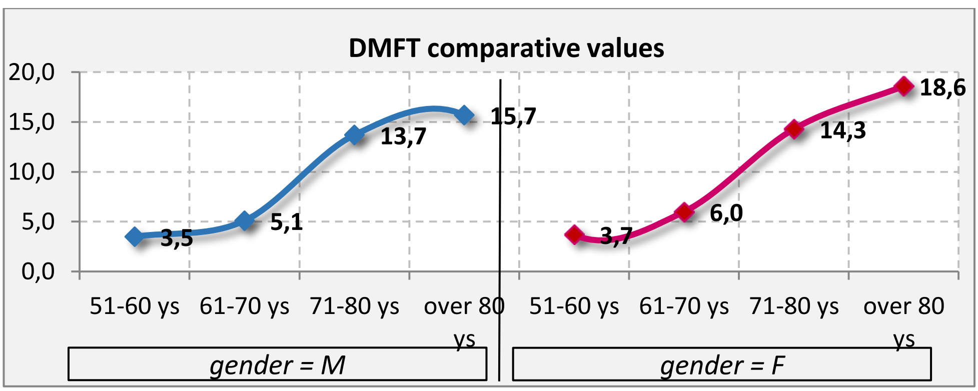

Fig. 3. Distribution of filled teeth by age group and place of residence

Identification of etiological factors of root caries assessment of individual cariogenic risk

Educational level. The distribution of patients according to educational level varied across age groups. In most groups, patients with secondary education predominated, with the highest proportions observed in the over 80-year group (64.1%) and the 51-60-year group (51.9%). These differences were statistically significant (Chi-square test, p = 0.011) (fig. 4).

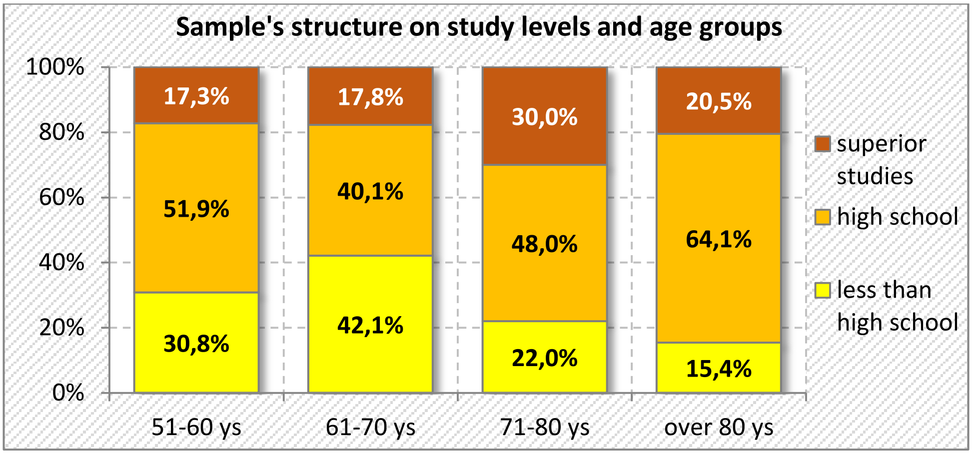

Fig. 4. Distribution of patients by age group and level of education

Place of residence. The majority of patients originated from urban areas, regardless of age group, with the highest percentages recorded in the 71-80-year group (76%) and the 61-70-year group (69.1%). However, the distribution according to place of residence was not statistically significant (Chi-square test, p = 0.075) (fig. 5).

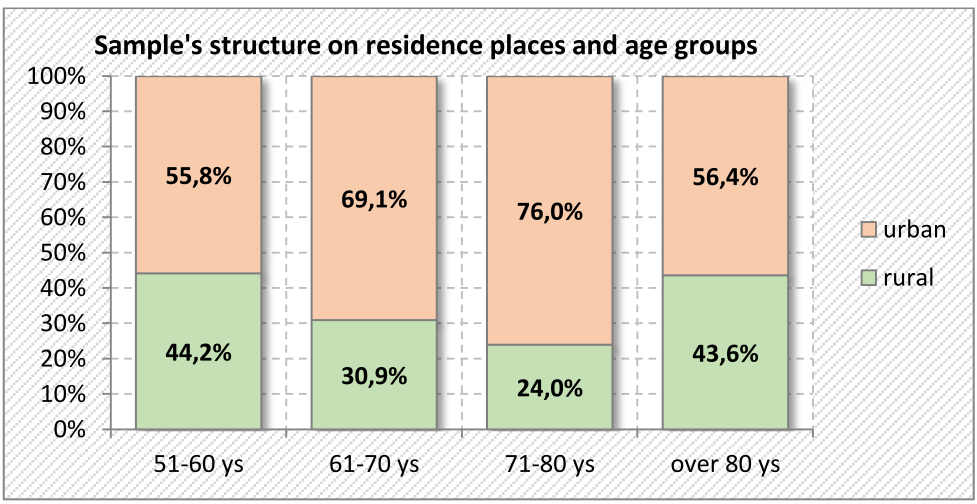

Fig. 5. Distribution of patients by age group and place of residence

TABLE IV.
The presence of associated systemic diseases by age groups

	Total		Age group								p-value†
			51-60 yrs.		61-70 yrs.		71-80 yrs.		over 80 yrs.		
	n	%	n	%	n	%	n	%	n	%	
Bronchial Asthma	28	9.5	3	5.8	16	10.5	6	12.0	3	7.7	0.675
Pulmonary emphysema	12	4.1			4	2.6	2	4.0	6	15.4	0.001**
High blood pressure	162	55.3	12	23.1	83	54.6	33	66.0	34	87.2	<0.001**
Heart rhythm disorders	50	17.1			14	9.2	18	36.0	18	46.2	<0.001**
Angina pectoris	48	16.4			16	10.5	15	30.0	17	43.6	<0.001**
Myocardial infarction	17	5.8			4	2.6	8	16.0	5	12.8	<0.001**
Congenital heart defects	2	0.7			2	1.3					0.600
Valve prostheses	4	1.3			4	2.6					0.288
Chronic hepatitis	104	35.5	16	30.8	48	31.6	18	36.0	22	56.4	0.030*
Liver cirrhosis	12	4.1			10	6.6	2	4.0			0.099
Diabetes Mellitus	30	10.2	1	1.9	21	13.8	7	14.0	1	2.6	0.026*
Epilepsy	9	3.0	1	1.9	6	3.9	2	4.0			0.572
Parkinson's disease	16	5.5			5	3.3			11	28.2	<0.001**
Previous stroke	1	0.4			1	0.7					0.818
Endocrine diseases	6	2.1	3	5.8	3	2.0					0.141
Osteo-articular diseases	53	18.1	7	13.5	28	18.4	12	24.0	6	15.4	0.545
Neuro-motor diseases	27	9.2	2	3.8	14	9.2	3	6.0	8	20.5	0.039*
Renal diseases	35	12.0	5	9.6	15	9.9	5	10.0	10	25.6	0.046*

†Chi-squared test; *p<0.05 statistically significant; **p<0.01 statistically highly significant

Associated Systemic Diseases. Systemic conditions with a potential indirect impact on the carious process were more frequently observed in patients over 80 years of age, particularly renal, hepatic, pulmonary, neuromotor, osteoarticular, and cardiovascular diseases (tab. IV).

Associated Medication. Medication with the potential to reduce salivary flow was more frequently observed in older age groups (tab. V). In almost all cases (with only one exception, the antidepressants) the differences recorded between age groups were statistically highly significant, as it follows: the use of diuretics increased progressively, from 11.5% in the 51-60-year group to 79.5% in patients over 80 years; a similar trend was observed for vasodilators, used by 48.7% of patients over 80 years; beta-blockers were also more frequently used in patients over 80 years (79.5%), followed by the 71-80-year group (60%); nitroglycerin use was highest among patients over 80 years (53.8%), compared to younger groups; similarly, Digoxin therapy was most frequent in the over 80-year group (41%); sedatives use was also more prevalent among patients over 80 years (28.2%).

TABLE V.

The distribution of medications with potential to reduce salivary flow rate by age groups

	Total		Age group								p-value†
			51-60 yrs.		61-70 yrs.		71-80 yrs.		over 80 yrs.		
	n	%	n	%	n	%	n	%	n	%	
Diuretics	133	45.4	6	11.5	65	42.8	31	62.0	31	79.5	<0.001**
Vasodilators	63	21.5			23	15.1	21	42.0	19	48.7	<0.001**
Beta-blockers	146	49.8	12	23.1	73	48.0	30	60.0	31	79.5	<0.001**
Nitroglycerin	64	21.8			23	15.1	20	40.0	21	53.8	<0.001**
Digoxin	39	13.3			12	7.9	11	22.0	16	41.0	<0.001**
Anticoagulants	19	6.5			9	5.9	3	6.0	7	17.9	0.007**
NSAIDs	146	49.8	12	23.1	69	45.4	34	68.0	31	79.5	<0.001**
Sedatives	23	7.9	3	5.8	8	5.3	1	2.0	11	28.2	<0.001**
Antidepressants	15	5.1	2	3.8	4	2.6	5	10.0	4	10.3	0.083

†Chi-squared test; *p<0.05 statistically significant; **p<0.01 statistically highly significant

Presence and Severity of Gingival Recession

The average number of teeth with gingival recession was higher in patients aged 51-60 years, followed by those aged 61-70, 71-80, and over 80 years. This decreasing trend with age may be explained by the reduction in the number of remaining teeth. The differences were not statistically significant (p = 0.063) (tab. VI). Regarding the severity of gingival recession, the highest average values were observed in the 71-80-year age group (2.81 mm), followed by the 61-70 (2.08 mm), over 80 (2.07 mm), and 51-60 (1.68 mm) groups; these differences were statistically significant (p = 0.006).

TABLE VI.

The level of caries by age groups

	Age group				Total M ± SD	p-value†
	51-60 yrs. M ± SD	61-70 yrs. M ± SD	71-80 yrs. M ± SD	over 80 yrs. M ± SD		
No. of teeth with gingival recession	5.83 ± 5.223	3.86 ± 4.149	3.34 ± 3.456	3.15 ± 3.305	4.02 ± 4.227	**0.063**
Severity of gingival recession (mm)	1.68 ± 1.274	2.08 ± 1.831	2.81 ± 1.904	2.07 ± 1.904	2.13 ± 1.793	0.006**

†Kruskal-Wallis test, **p < 0.01 Statistically highly significant

DISCUSSION

The results of the present study highlight that caries involvement exhibits an age-dependent profile, with a higher prevalence of coronal lesions in younger age groups and a progressive increase in root caries among elderly patients. This pattern is consistent with current epidemiological trends, which indicate a decline in dental caries in younger populations and an increased burden in older age groups (1).

In this study, the 51-60-years age group presented the highest number of carious teeth, whereas root caries lesions were more frequent in patients aged 71-80 years. This distribution supports the concept that, with advancing age, local factors such as root surface exposure and periodontal changes become major determinants of the carious process (2).

The increased DMFT values observed in older age groups, particularly in patients over 80 years, can be explained by the higher contribution of the “M” component, reflecting tooth loss as a consequence of caries complications. This finding suggests that, in elderly patients, cumulative caries experience is more relevant than the incidence of active lesions and is influenced by previous treatment history and access to dental care.

Regarding lesion localization, the predominance of dentin caries in the 51-60-year group and root caries in the 71-80-years group indicates a shift in the pattern of caries involvement with aging. Recent meta-analyses have reported a global prevalence of root caries of approximately 41%, emphasizing its importance in geriatric oral pathology (4).

Socio-economic factors showed a significant influence of educational level on patient distribution, while place of residence was not significantly associated with caries risk. These findings are partially consistent with the literature, suggesting that education influences oral health behaviors, whereas urban-rural differences are becoming less pronounced due to improved access to healthcare services.

Systemic diseases and associated medication play a crucial role in the development of root caries. In the present study, patients over 80 years exhibited the highest prevalence of systemic conditions and xerostomia-inducing medications (diuretics, beta-blockers, vasodilators, nitroglycerin, and digoxin). These results support previous findings that identify hyposalivation as a major risk factor for root caries, due to reduced buffering capacity and impaired antimicrobial function of saliva (5).

The higher prevalence of xerostomia in older age groups further supports the direct relationship between reduced salivary flow and increased cariogenic risk. Under these conditions, alterations in the oral microbiota favor the proliferation of acidogenic microorganisms, particularly *Streptococcus mutans* and Lactobacilli, which are implicated in the etiology of root caries.

Gingival recession represents another important determinant, through the exposure of root surfaces. Although the number of teeth affected by recession was higher in younger groups, the severity was significantly greater in patients aged 71-80 years. This finding suggests that the severity of gingival recession, rather than its mere presence, plays a key role in the development of root caries.

The plaque index showed higher values in the 61-80-years age groups, without statistically significant differences, indicating that poor oral hygiene remains a consistent factor across all age groups. Epidemiological studies have identified inadequate oral hygiene as one of the strongest predictors of root caries (6).

Microbiological analysis revealed a substantial proportion of patients classified as having moderate to high cariogenic risk, based on the levels of *Streptococcus mutans* and Lactobacilli. Recent studies confirm the role of these microorganisms in the initiation and progression of root caries, although the etiology is considered polymicrobial (2).

Overall, the findings of this study confirm the multifactorial nature of root caries, resulting from the interaction between local factors (dental plaque, gingival recession), systemic conditions (general diseases, medication), behavioral aspects (oral hygiene, diet), and biological factors (saliva, oral microbiota). Modern models of cariogenic risk assessment integrate these variables into predictive approaches aimed at prevention and personalized treatment strategies.

CONCLUSIONS

Caries involvement varies with age, with a predominance of coronal lesions in younger age groups and an increased prevalence of root caries in elderly patients, particularly in the 71-80-years age group.

The DMFT index showed an increasing trend with advancing age, mainly due to the "M" component (missing teeth), reflecting cumulative tooth loss associated with complications of dental caries.

Both systemic and local factors, including general diseases, xerostomia-inducing polypharmacy, and gingival recession, contribute significantly to the development and progression of root caries lesions.

Reduced salivary flow rate and buffering capacity in elderly patients represent key determinants in increasing caries susceptibility, especially at the level of exposed root surfaces.

Increased salivary microbial load, characterized by elevated levels of *Streptococcus mutans* and Lactobacilli, is associated with moderate to high cariogenic risk in the majority of patients.

The overall cariogenic risk is higher in older age groups, particularly in patients aged 71-80 years, confirming the multifactorial nature of dental caries and the need for individualized preventive and therapeutic approaches.

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