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CLINICAL CONSIDERATIONS OF DENTAL LONGEVITY FROM THE LATERAL AREA

Florica Voiță-Mekereș[1], Gheorghe Florin Voiță[2], Mihaela Dana Pogan[3]*, Cristian Delcea[4], Felicia Manole[5], Gabriel Mihai Mekereș[6], Larisa Bianca Galea-Holhoș[1], Daniela Domocos[3]

1. ***Department of Morphology, Faculty of Medicine and Pharmacy, University of Oradea, Romania.***
2. ***Dental Office 'Dr. Voiță Gheorghe Florin', Oradea, Romania.***
3. ***Department of Dental Medicine, Faculty of Medicine and Pharmacy, University of Oradea, Romania.***
4. ***Department of Forensic Medicine, "Iuliu Haţieganu" University of Medicine and Pharmacy, 400000 Cluj-Napoca, Romania.***
5. ***Department of Surgery, Faculty of Medicine and Pharmacy, University of Oradea, Romania.***
6. ***Faculty of Medicine and Pharmacy, University of Oradea, Romania, University of Oradea, Romania.***

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ABSTRACT

In dentistry, it is well known that the occlusal surface, which contains grooves and dimples, on the posterior surface of the tooth, is the most likely area where cavities may initially form. The aim of this prospective study is to better understand dental longevity, and the process of tooth decay and to develop more effective treatment protocols for use by dentists to better treat their patients. Historically, in Romania, there has been a reduced impetus to fully and accurately assess the overall health of a patient's teeth. However, nowadays, new studies and methodologies are needed to help better quantify tooth decay. Moreover, a radiological examination was performed on each patient involved in this prospective study, as well as follow-up radiological examinations, when required, based on the treatment administered. In summary, this prospective study into dental longevity, tooth decay, and the development of better treatment protocols is the first attempt of its kind, in Romania, to analyze the effects of tooth decay on the general population.

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Introduction

Tooth decay is a globally recognized public health challenge. Dentists have different opinions and thoughts on how to best treat this pathology. Traditionally, the treatment protocol called for extraction [1]. In 2020 however, because of advances in dental medicine and better paraclinical investigational methods, the need for extraction has been reduced, even eliminated, giving the dentist the ability to save the affected tooth [2-4].

Cavities are formed by various chemical and biological agents and interactions which, in time, damage the enamel. Some of these agents include acid-producing bacteria and fermentable carbohydrates [5]. Furthermore, there are host factors that dictate the promotion and prevalence of tooth decay; two of these host factors include tooth resilience (genetic predisposition) and saliva (hypersalivation – alkaline, hyposalivation-acidic) [6-8]. Tooth decay may occur in young children and even infants (may be aggressive and adversely affect the various stages of dentition). In adults, tooth decay may lead to coronary disease and even radiculopathy [9-11]. There are some rare genetic disorders, such as Jacobsen syndrome, in which patients have a

Corresponding Author: Mihaela Dana Pogan; Department of Dental Medicine, Faculty of Medicine and Pharmacy, University of Oradea, Romania. E-mail: mihaela.pogan@csud.uoradea.ro.

greater propensity for tooth decay due to having dental abnormalities, requiring long-term specialized dental care [12-14]. The risk of developing tooth decay comes from a multitude of factors [15, 16]. These include physical, biological, environmental, behavioral, and lifestyle factors, which may lead to a high number of cariogenic bacteria in the buccal cavity (not using mouthwash), an inadequate salivary flow (dehydration), insufficient exposure to stannous fluoride (not using toothpaste while brushing), eating lots of sugary foods (candy), and, in general, a state of poor oral hygiene [17-19].
Featherstone's meta-analysis study shows that the prevalence of tooth decay and severe periodontitis is high, with untreated tooth decay being the most common disease affecting people worldwide [20].
This prospective study aims to better understand dental longevity and the tooth decay process to develop more effective treatment protocols for use by dentists to better treat their patients.

Materials and Methods

The patients included in this study, in the first phase, were consulted and examined at his dental practice in Dental Office 'Dr. Voita Gheorghe Florin', Oradea, Romania and at the Royal Dental Center, Sighetu Marmației, Romania. The patients were divided into two groups: an experimental group and a control group. They were consulted and examined to establish whether or not a diagnosis of tooth decay would be warranted. Additionally, a group of these patients underwent either a more conservative form of treatment or surgical treatment for their associated diagnosed dental pathology. Furthermore, the patients who were consulted, examined, and subsequently treated were given systemized and on-demand information about the efficacy of treatment. In brief, clinical management and follow-up consultation provided for an overall review of patients' well-being and progress; this was performed, in concert, with supportive counseling and a limited set of recommendations.
Along with the demographic data (age, sex, home/work environment, ethnicity, socio-economic status, etc.) recorded on all patients in this study, all received the necessary extrabuccal, intrabuccal, and radiological examination.
Based on the familial data obtained from patients in the study, we were able to determine whether or not patients were related (degree of kindship I and II) and used this data for our research.
The clinical and paraclinical examination was aimed at the lateral group in each hemisphere of the two supporting arches at the level of each jaw. 16 teeth were analyzed: four first premolars (14, 24, 34, 44), four-second premolars (15, 25, 35, 45), four first molars (16, 26, 36, 46), and four-second molars (17, 27, 37, 47), per FDI World Dental Federation notation.
Tooth characteristics were included in the study and were grouped into four categories, following the clinical-radiological analysis:

- missing tooth/teeth;
- devitalized tooth (with or without endodontic treatment);
- vital tooth (which has a cavity or simple filling);
- intact tooth.

The study includes a total of 238 patients between the ages of 12 and 91 years old of which 140 were women (58.8%) and 98 men (41.2%) **(Table 1)**.
The participants included in the study were divided into two groups according to the objectives presented above. Thus, the first group included patients with edentulousness (N = 177) while the second group included participants with complete dentition (N = 61).
The inclusion criteria in our study were: patients who presented at least a carious lesion or edentulousness in the lateral area of the arches; patients over the age of 12.
Exclusion criteria: tooth decay in the frontal area of arches; patients who refused to participate in the study; traumatic dental injuries; absent comprehension.
The study addressed a group of 177 edentulous patients in the lateral dental area, represented by the first and second premolar, and first and second molar, in different ratios. The patients followed (N = 177) benefited from a dental consultation, in some patients, edentulousness was observed, and some patients required surgical treatment to extract the compromised tooth.
The radiological examination was performed on patients as many times as necessary, before and after treatment use administrated.
Statistical analysis
Data is presented as mean and standard deviation for numerical variables with Gaussian distribution, or as median and quartile, numerical variables with non-Gaussian distribution. Nominal variables are expressed as numbers and percentages. To compare the demographic characteristics 1, the Chi-square test ($\chi 2$) was used and the Mann-Whitney U test was used to compare numerical variables with non-Gaussian distribution.
To establish the association between the quality of the dentition and its distribution on each hemi-arcade, we used the Fisher Exact test or the Freeman-Halton test. A p-value <0.05 was used as the threshold for statistical significance.
Data was processed using Microsoft Excel (Office 2016, Microsoft Corporation, Redmond, WA), and statistical analysis was performed using IBM SPSS (Statistics v26, International Business Machines Corp, NY).

Results and Discussion

Of a total of 238 patients in the study, 177 (74.4%) had various forms of edentulousness and 61 (25.6%) had complete dentition. Edentulous patients had a median age (IQR) of 40 [29-51.5], and patients with complete dentition, had a median age of 16 [13-20] **(Figure 1)**, with statistically significant differences between the two groups (p <0.001; Mann-Whitney U test).

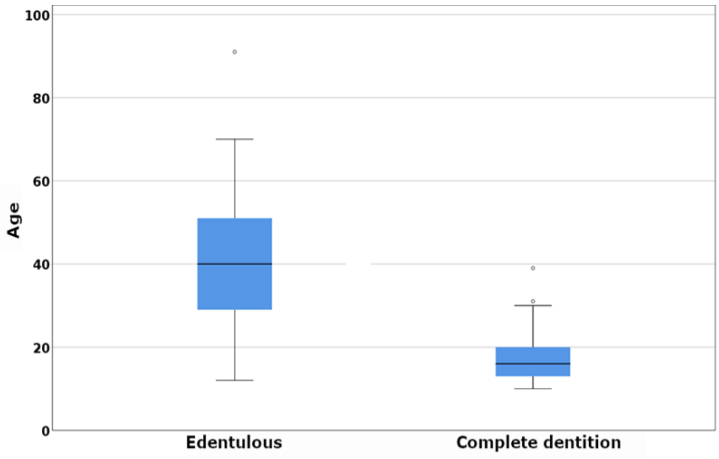

Figure 1. Age of edentulous patients/complete dentition

Patients came from both rural (65; 36.7%) and urban (112; 63.3%) settings. Additional data for demographic variables are presented in **Table 1**.
From an occupational perspective, the consecutive group included 39 (22%) patients with a low socio-economic status (SES), 93 patients (52.5%) with an income in a middle SES, and 45 patients (25.4%) with a high socio-economic status.

Table 1. Demographic data for the edentulous patient group (N = 177) and the control group (N = 61);

Variables		Edentulous (N=177)	Complete dentition (N=61)	P
Gender	Male	70 (71.4%)	28 (28.6%)	0.385
	Female	107 (76.4%)	33 (23.6%)	
The environment of origin	Rural	65 (36.7%)	28 (45.9%)	0.205
	Urban	112 (63.3%)	33 (54.1%)	
Ethnicity	Romanian	142 (80.2%)	47 (77%)	0.632
	Hungarian	24 (13.6%)	11 (18%)	
	Ukrainian	8 (4.5%)	3 (4.9%)	
	Roma	3 (1.7%)	0	
Education	Gymnasium	33 (18.6%)	19 (31.1%)	0.017
	High school	95 (53.7%)	33 (54.1%)	
	Higher education	49 (27.7%)	9 (14.7%)	
SES	Low	39 (22%)	8 (13.1%)	0.269
	Middle	93 (52.5%)	38 (62.3%)	
	High	45 (25.4%)	15 (24.6%)	

The risk of edentulism is greater in females from urban areas, who have an average educational and SES.
The group with complete dentition consisted of 61 participants aged between 12 and 33 years old. Thirty-three were women and 28 were men; 28 participants came from a rural setting and 33 from an urban one.

Table 2. The situation of the teeth in the upper hemi-arcade (1)

Tooth	Edentulous	Devitalized tooth	Vital tooth	Whole tooth
14	63 (26.5%)	42 (17.6%)	67 (28.2%)	66 (27.7%)
15	63 (26.5%)	52 (21.8%)	70 (29.4%)	53 (22.3%)
16	83 (34.9%)	35 (14.7%)	97 (40.8%)	23 (9.7%)
17	51 (21.4%)	25 (10.5%)	113 (47.5%)	49 (20.6%)

24	70 (29.4%)	46 (19.3%)	68 (28.6%)	54 (22.7%)
25	60 (25.2%)	44 (18.5%)	76 (31.9%)	58 (24.4%)
26	98 (41.2%)	30 (12.6%)	86 (36.1%)	24 (10.1%)
27	42 (17.6%)	26 (10.9%)	120 (50.4%)	50 (21%)

Table 2 shows tooth 16 is most frequently extracted and tooth 14 has the lowest risk of being affected by cavities; the value P <0.001, means there is a statistical difference in the health of the teeth (16 and 14) on the same arch.
I most frequently lost tooth is the upper left molar (26); the premolar I (24) required endodontic treatment in an increased percentage (19,3%); the second molar (27) showed simple tooth decay at the highest percentage rate from the hemi-arcade level; the premolar II (25) was intact in most patients studied ($\chi 2 = 65.6911$. p <0.001) **(Table 2)**.

Table 3. The health of the teeth in the lower hemi-arcade (3)

Tooth	Edentulous	Devitalized tooth	Vital tooth	Whole tooth
34	31 (13%)	18 (7.6%)	104 (43.7%)	85 (35.7%)
35	48 (20.2)	20 (8.4%)	106 (44.5%)	64 (26.9%)
36	131 (55%)	29 (12.2%)	57 (23.9%)	21 (8.8%)
37	59 (24.8%)	29 (12.2%)	112 (47.1%)	38 (16%)
44	32 (13.4%)	28 (11.8%)	97 (40.8%)	81 (34%)
45	52 (21.8%)	20 (8.4%)	108 (45.4%)	58 (24.4%)
46	126 (52.9%)	31 (13%)	59 (24.8%)	28 (9.2%)
47	67 (28.2%)	31 (13%)	98 (41.2%)	42 (17.6%)

At the level of the lower left hemi-arcade, tooth 36 (lower left first molar) has the highest percentage of edentulousness, respectively at 55%, at the opposite pole being tooth 34 (lower left premolar I) as the most present, as shown in **Table 3**.
Analyzing **Table 3**, we found that the lower right six-year molar (46) is predominantly lost, with a percentage of 52.9% in the hemi-arcade ($\chi 2 = 117,9401$, p <0.001).

Table 4. Condition of the first and second premolar

Tooth	Edentulous	Devitalized tooth	Vital tooth	Whole tooth
14	63 (26.5%)	42 (17.6%)	67 (28.2%)	66 (27.7%)
24	70 (29.4%)	46 (19.3%)	68 (28.6%)	54 (22.7%)
34	31 (13%)	18 (7.6%)	104 (43.7%)	85 (35.7%)
44	32 (13.4%)	28 (11.8%)	97 (40.8%)	81 (34%)
15	63 (26.5%)	52 (21.8%)	70 (29.4%)	53 (22.3%)
25	60 (25.2%)	44 (18.5%)	76 (31.9%)	58 (24.4%)
35	48 (20.2%)	20 (8.4%)	106 (44.5%)	64 (26.9%)
45	52 (21.8%)	20 (8.4%)	108 (45.4%)	58 (24.4%)

Table 4 shows that among the premolars, the one located at the level of the lower left hemi-arcade (tooth 34) is the most resistant, remaining intact at 35.7% at the time ($\chi 2 = 62.1851$, p <0.001).
Among the second premolars, the one located in the upper left hemi-arcade (tooth 25) is the least resilient remaining edentulous 25.2%, in 60 patients examined ($\chi 2 = 40,706$, p <0.001) **(Table 4)**.

Table 5. Health status of the first and second molar

Tooth	Edentulous	Devitalized tooth	Vital tooth	Whole tooth
16	83 (34.9%)	35 (14.7%)	97 (40.8%)	23 (9.7%)
26	98 (41.2%)	30 (12.6%)	86 (36.1%)	24 (10.1%)
36	131 (55%)	29 (12.2%)	57 (23.9%)	21 (8.8%)
46	126 (52.9%)	31 (13%)	59 (24.8%)	28 (9.2%)
17	51 (21.4%)	25 (10.5%)	113 (47.5%)	49 (20.6%)
27	42 (17.6%)	26 (10.9%)	120 (50.4%)	50 (21%)
37	59 (24.8%)	29 (12.2%)	112 (47.1%)	38 (16%)

47	67 (28.2%)	31 (13%)	98 (41.2%)	42 (17.6%)

From **Table 5** above, we can determine that the first molar located at the level of the left lower hemi-arcade (tooth 36) is the most frequently affected, remaining edentulous in 55% of patients evaluated ($\chi2 = 31.8553$, $p = 0.002$).
TThe second molar, located at the level of the right inferior hemi-arcade (tooth 47) is the most frequently affected, remaining edentulous in 67 (28.2%) of patients; according to the statistical test used ($\chi2 = 11.6236$, p-value = 0.023), statistically significant **(Table 5)**.

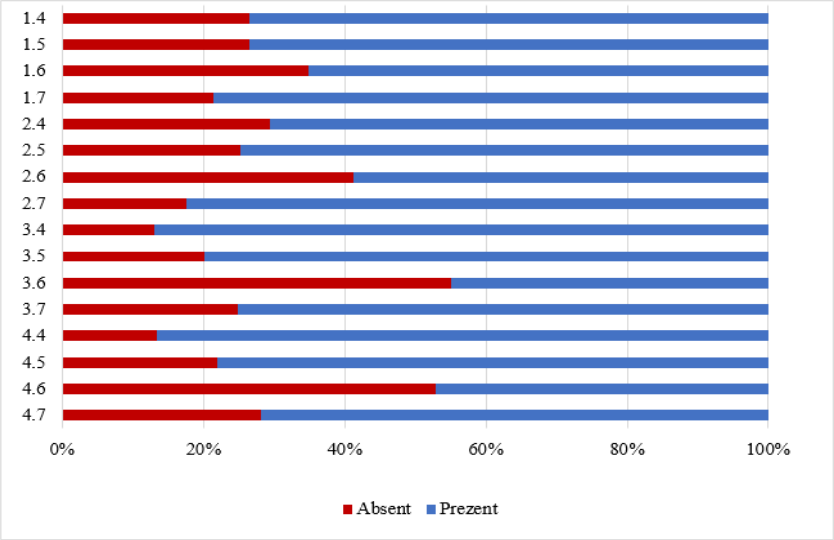

Figure 2. Degree of edentulism in the patients as a percentage (%)

Figure 2 shows that the left lower, first molar (36) is the most affected by tooth decay, the opposite pole being the lower first premolars (34 and 44), being the least affected.
The results and conclusions obtained from this study may be used as a guide for helping dentists to better asses the prevalence and severity of tooth decay for their patients. In addition, dentists will be better able to develop exceptional treatments based on the empirical data produced.
The results obtained and the statistical processing of demographic data in this study indicate that most patients ranged in age from 13-20 years with a median of 16 years for patients with full dentition, and in the case of edentulous patients the median was 40 years, which corresponds to studies presented by Broadbent in which it shows that important various processes and the experience of tooth loss occur as people pass from the third to the fourth decade of life [21].
Griffin in his article "Estimating Rates of New Root Caries in Older Adults" also suggests that older adults have high rates of new caries, the solution could be to implement dental caries prevention programs [22].
Our study shows that women had more affected dentition, these data were influenced by the increased addressability of women compared to men. In a study conducted by Klein *et al*., the analysis of dental examinations of 2,232 boys and 2,184 girls indicates that the experience of dental caries is higher in girls compared to boys of the same chronological age; but girls 'teeth erupt earlier than boys'; therefore they have a higher postoperative age of the teeth, being more exposed to the risk of carious processes. Based on these findings, it is concluded that girls are not more susceptible to tooth decay compared to boys [23].
From the point of view of the environment of origin, we noticed that most of the edentulous patients came from urban areas (63.3%) in contradiction with a specialized study conducted in Romania, in its central area, in 2014 which highlights the fact that the percentage of carious processes and e edentulousness is higher in rural areas [24].
The differences between the present study and the one carried out by Frâncu are described by the fact that patients from rural areas have a lower dental addressability, so they are often underdiagnosed. Therefore, the late presentation for dental examination results in the diagnosis of advanced pathology, sometimes the only treatment left is extraction [25].
In our observation series, the left lower first molar (36) was significantly more frequently affected, with a percentage of 55% **(Table 4)**. No epidemiological work has been found on the longevity of the first molar.
In Romania, all patients can benefit from fully or partially compensated dental services, provided by the Health Insurance House, but these are insufficient. It would be recommended that these funds take into account the level of addressability of patients.
From the analysis of the 16 teeth located in the lateral area of the upper right hemi-arcade, it results that tooth 16 (upper right first molar) is the most frequently extracted, having multiple dental consequences: the inclination of the right upper second molar (tooth 17) towards the mesial, difficulties of mastication, excretion of the antagonistic tooth.

At the level of the upper left hemi-arcade, the most frequently lost tooth is the upper left molar (tooth 26). The upper left hemi-arcade has tooth 36 (lower left first molar) with the highest degree of edentulousness at 55%, and the lower right hemi-arcade, tooth 46, at 52.9%.

From these results it can be seen that the six-year-old molar is the most affected in each hemi-arcade, in the long run, there are difficulties in prosthesis of the lost tooth due to collapse of the occlusion and migration of teeth vertically and horizontally. These results correspond to those published by Frățilă and collaborators, in a clinical-statistical study performed for five years on a group of 198 patients aged between 21 and 40 years, whose six-year molars were extracted early in childhood [26]. Early loss of six-year-old molars causes changes in the function of the dental-maxillary system, in particular by affecting the sagittal occlusion produced by the migration of teeth [27]. If edentulousness occurred around the age of 7-9 years, changes in the maxillary system are more extensive. Twelve-year-old molars that limit the edentulous gap experience wider positional changes than premolars, and patients who remain edentulous until maturity show irreversible changes in the teeth [28].

The result of our study regarding the six-year-old molar is consistent with other studies on this topic, these permanent teeth were named by Kunzel (1988) the problem of the child in pediatric dentistry [29]. The carious lesions present at the level of the six-year-old molar evolve rapidly, once the destruction of the dental crown and the appearance of periapical inflammatory processes that make the molars irretrievable since childhood.

Moreover, the carious processes can lead to psychological and social repercussions for both the child and the adult, with long-term negative effects such as withdrawal and social stigmatization [30, 31]. Therefore, the detection of the disease before presenting symptoms, as well as the treatment of complications in patients already diagnosed becomes a necessity, considerably reducing the costs of this condition [32].

Conclusion

The dental longevity in the lateral area has an uneven distribution, the edentulous percentage varying between 13.0% for the left lower first premolar to 55.0% for the right lower first molar. The lower, left (tooth 36) and right (tooth 46), molars are most commonly affected. The left and right lower premolars have the longest longevity (teeth 34 and 44). The predisposition of each tooth in the lateral area to be affected can be a criterion for selecting priorities in the treatment of dental caries. Endogenous factors (female) and exogenous factors (urban environment, secondary schooling, and average economic level) are factors that favor dental caries.

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Conflict of interest: None

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Ethics statement: The study was conducted according to the guidelines of the Declaration of Helsinki and was approved by the Dental Office 'Dr. Voita Gheorghe Florin', Oradea, Romania, Nr. 2/20.12.2020 and by Royal Dental Center, Sighetu Marmației, Romania. Nr. 22/03.01.2020.

Written informed consent was obtained from all subjects enrolled in the study.

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