

## PERIODONTAL CHANGES IN CHILDREN WITH INSULIN-DEPENDENT DIABETES MELLITUS

Burculeț Raoul-Ciprian<sup>1</sup>, Foia Liliana<sup>2+</sup>, Botnariu Gina<sup>3+</sup>, Adumitroaie Alina<sup>4</sup>,  
Checheriță Laura<sup>5</sup>, Toma Vasilica<sup>6</sup>

<sup>1</sup>Dentist, private practice, Iasi, Romania

<sup>2,4,6</sup>Department of Surgery, Faculty of Dental Medicine, University of Medicine and Pharmacy, “Grigore T. Popa”, 700115 Iasi, Romania

<sup>3</sup>Medical II Department, Faculty of Medicine, University of Medicine and Pharmacy, “Grigore T. Popa”, 700115 Iasi, Romania

<sup>5</sup>2nd Dental Medicine Department, Faculty of Dental Medicine, “Grigore T. Popa” University of Medicine and Pharmacy, 700115 Iasi, Romania

<sup>+</sup>Corresponding authors: Foia Liliana; *e-mail*: georgeta.foia@umfiasi.ro;  
Botnariu Gina; *e-mail*:

### ABSTRACT

**Aim of the study** The aim of this study was to monitor and assess the periodontal changes in a group of children diagnosed with Insulin-Dependent Diabetes Mellitus (IDDM), by correlating their periodontal status with the level of metabolic control of the disease, in order to highlight the impact of diabetes on oral health during childhood.

**Materials and methods** The clinical study included two groups of children aged between 4 and 18 years. The control group consisted of 30 healthy patients with no systemic pathologies. The study group comprised 30 children diagnosed with IDDM, under medical supervision in the "Nutrition Disorders" Department of the “Sf. Maria” Emergency Clinical Hospital for Children in Iași. The clinical examination focused on evaluating three periodontal health parameters: the plaque staining index (QH), the gingival inflammation index (GI), the papillary bleeding index (PBI), and the level of clinical attachment loss (CAL). Periodontal diagnosis was performed according to internationally accepted standardized criteria.

**Results** The results showed significantly increased values of all analyzed indicators in the study group with poorly controlled metabolic IDDM children, compared to the control group. Gingival inflammation was particularly pronounced in diabetic patients, suggesting increased vulnerability of the periodontal tissues in the context of diabetes mellitus.

**Conclusions** Children diagnosed with Insulin-Dependent Diabetes Mellitus are at significantly increased risk of periodontal involvement, with clinical manifestations being more severe in those with poor metabolic control. These results highlight the need for rigorous monitoring and interdisciplinary collaboration between the diabetologist and the pediatric dentist, in order to optimize the oral health of these patients and prevent the periodontal complications commonly seen in diabetic adults.

**Key words:** diabetes mellitus, child, gingival inflammation, bacterial plaque, oral prevention.

### INTRODUCTION

Insulin-Dependent Diabetes Mellitus (IDDM), also known as type 1 diabetes, is one of the most common chronic diseases of childhood, having a significant impact on general health, including oral health [1]. The characteristic metabolic imbalances of IDDM influence the inflammatory and immunological processes of the periodontium, increasing susceptibility to periodontal diseases [2]. Although marginal periodontitis is not commonly seen in

childhood, in patients with IDDM periodontal changes may occur early, characterized by severe gingival inflammation, periodontal attachment loss, and alveolar bone resorption [3]. This association can be explained by chronic hyperglycemia, which promotes the formation of advanced glycation end products (AGEs) and alters the local immune response, thereby stimulating tissue destruction [4]. Moreover, poor glycemic control has been shown to be directly

correlated with the severity of periodontal involvement, while good glycemic management can improve the clinical signs of periodontal disease [5]. In children, additional factors such as difficulties in maintaining proper oral hygiene or the lack of specific health education further contribute to the worsening of the periodontal status [6]. Understanding the relationship between IDDM and periodontal changes during childhood is essential for developing effective prevention and treatment strategies aimed at reducing the disease's impact on the quality of life of pediatric patients.

### AIM OF THE STUDY

The aim of this study was to monitor and evaluate periodontal changes in a group of children diagnosed with Insulin-Dependent Diabetes Mellitus (IDDM), by correlating their periodontal status with the level of metabolic control of the disease, in order to highlight the impact of diabetes on oral health during childhood.

### MATERIALS AND METHOD

For the purpose of this study, we included cases under treatment at the Pediatric Dentistry Clinic of the “Grigore T. Popa” University of Medicine and Pharmacy in Iași during the period 2024–2025, as well as patients from the “Nutrition Disorders” Department of the ‘St. Mary’ Emergency Clinical Hospital for Children in Iași. A total of 80 children and adolescents aged between 4 and 18 years old were evaluated, of whom 35 were boys and 45 were girls. Among these, 60 patients (35 girls, 25 boys) presented with periodontal symptoms, such as gingival inflammation, easily provoked or spontaneous gingival bleeding, gingival pruritus, and pain.

Two groups of pediatric patients were established:

- Control group: 30 children without systemic conditions, who presented to the Pediatric Dentistry Clinic in Iași for the treatment of various dental conditions;
- Study group: 30 children with Insulin-Dependent Diabetes Mellitus (IDDM), from the “Nutrition Disorders” Department of the “St. Mary” Emergency Clinical Hospital for Children in Iași. This group was further divided into two subgroups based on the degree of metabolic control, assessed by glycated hemoglobin (HbA1c) levels:
  - Group A: 14 patients with  $HbA1c < 7\%$
  - Group B: 16 patients with  $HbA1c > 7\%$



Figure 1. Collaboration Agreement – ‘St. Mary’ Emergency Clinical Hospital for Children, Iași

None of the patients included in this study had received antibiotic treatment or antiseptic mouth rinses within six months prior to the clinical and biological assessments, and all patients were non-smokers.

### Control Group

**In the control group, the following were performed:**

1. The clinical observation form with a pedodontic focus was completed (developed by the Department of Pediatric Dentistry of the “Grigore T. Popa” University of Medicine and Pharmacy, Iași), based on intraoral and extraoral clinical examination, supplemented with information from the periodontal observation form of the Department of Periodontology of the same university.

- Emphasis was placed on the clinical status of the periodontium, evaluated through:
  - a) **Inspection** (color, insertion of the junctional epithelium, integrity)
  - b) **Palpation** (gingival response or texture)
  - c) **Periodontal probing** (presence or absence of periodontal pockets and their depth)

The following elements were assessed:

- Shape of the dental arches
- Provoked and spontaneous gingival bleeding
- Clinical attachment loss (CAL)

2. The observation forms were supplemented with paraclinical examinations:

- i. Colorimetric evaluation of bacterial plaque – Quigley-Hein Plaque Index (QH)
- ii. Assessment of oral hygiene – Oral Hygiene Index (OHI)
- iii. Assessment of gingival inflammation – Gingival Index (GI)
- iv. Evaluation of Papillary Bleeding (PBI)
- v. Extraoral and intraoral photographs were taken to document and authenticate the study.

## Study Group

Processing of the Diabetes History from the hospital clinical medical records:

- a) General information: name, surname, age, sex, place of residence (urban or rural)
- b) Family history: presence of diabetes mellitus and its complications in family members
- c) Personal medical history: presence of

other systemic conditions, whether or not associated with diabetes  
d) History of IDDM – for each patient, the following aspects were recorded:

1. Age of diabetes onset
2. Type of diabetes
3. Age at diagnosis
4. Disease duration
5. Treatment administered
6. Disease progression
  - e) Laboratory data:
    - i. Blood glucose level
    - ii. Glycated hemoglobin (HbA1c) level
2. Completion of a clinical observation form with a pedodontic focus
3. Paraclinical examinations:
  - a) Assessment of oral hygiene – Oral Hygiene Index (OHI)
  - b) Colorimetric evaluation of bacterial plaque – Quigley-Hein Index (QH)
  - c) Assessment of inflammation – Gingival Index (GI)
  - d) Assessment of papillary bleeding – Papillary Bleeding Index (PBI)
  - e) Extraoral and intraoral photographs to document and validate the study

## Informed Consent

Prior to any evaluation, informed, authorized, and motivated consent was obtained from both the parents or legal guardians and the specialist physicians monitoring the cases. (Fig. 2)

UNIVERSITATEA DE MEDICINĂ ȘI FARMACIE  
"GRIGORE T. POPA" IAȘI

CONȘTIȚĂȚĂRIE INFORMATĂ ÎN CERCETARE

Scutim rugă să citiți acest formular cu mare atenție și să puneți orice întrebare relevantă în prezența medicului responsabil și a medicului de familie sau în cadrul la care vi s-a făcut testul, înainte de a accepta să participați și să vă dați acordul final în scris.

Scutim rugă să participați la o cercetare, cu titlu "Modificările din starea orală în contextul bolii sistemice cu diabet zaharat", în scopul scopului. **Scutim rugă să participați la o cercetare, cu titlu "Modificările din starea orală în contextul bolii sistemice cu diabet zaharat", în scopul scopului.**

Vi se va cere să vă dați acordul detașat de la a (c) sau să vă dați acordul în scris.

Informațiile pe care le furnizați în acest formular vor fi utilizate doar în scopul studiului și nu vor fi divulgate altcuiva. Rezultatele vor fi prezentate în mod anonim. Rezultatele vor fi prezentate în mod anonim. Rezultatele vor fi prezentate în mod anonim.

Scutim rugă să participați la o cercetare, cu titlu "Modificările din starea orală în contextul bolii sistemice cu diabet zaharat", în scopul scopului. **Scutim rugă să participați la o cercetare, cu titlu "Modificările din starea orală în contextul bolii sistemice cu diabet zaharat", în scopul scopului.**

Utilizăm, pentru scopul cercetării, datele personale pe care le furnizați în acest formular. Datele personale pe care le furnizați în acest formular vor fi utilizate doar în scopul studiului și nu vor fi divulgate altcuiva. Rezultatele vor fi prezentate în mod anonim. Rezultatele vor fi prezentate în mod anonim. Rezultatele vor fi prezentate în mod anonim.

Am citit și am înțeles acest formular de consimțământ și am dat acordul în scris să particip la studiul de cercetare. Primim o copie a acestui formular.

Data: 21/09/2024

Numele în care al subscris (ASINSCRE):

Semnatura:

Figure 2. Informed Consent  
Clinical Cases

### A. Control Group

1. Patient H.E., Age: 17 years  
General health: unaffected by any systemic condition



Figure 3. Intraoral clinical appearance

**Periodontal diagnosis: predominantly bacterial gingivitis**

|     |     |
|-----|-----|
| IQH | 2   |
| GI  | 0   |
| PBI | 1,5 |
| PAC | 0   |

Table 1. Indices for patient H.E

### B. IDDM group

- 2) Patient S.A.Ş., Age: 17 years  
General health diagnosis: Insulin-Dependent Diabetes Mellitus

|                             |                                                                         |
|-----------------------------|-------------------------------------------------------------------------|
| Duration of diabetes        | 12 years                                                                |
| Numbers of hospitalizations | 6                                                                       |
| AP                          | -born at term<br>(Gn=3250g, Apgar=7)<br>-Type 1 Diabetes Mellitus- 2013 |
| AH                          | -mother, father-<br>apparently healthy                                  |
| HbA1c                       | >7%                                                                     |

Table 2 : Medical History of patient S.A.Ş

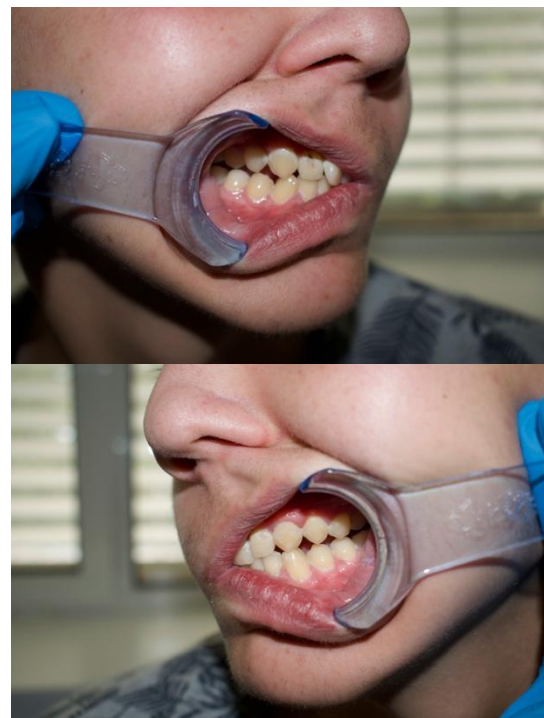




Figure 4. Intraoral clinical appearance

|            |      |
|------------|------|
| <b>IQH</b> | 4    |
| <b>GI</b>  | 2    |
| <b>PBI</b> | 1.33 |
| <b>PAC</b> | 1 mm |

Table 3: Indices for patient S.A.Ş

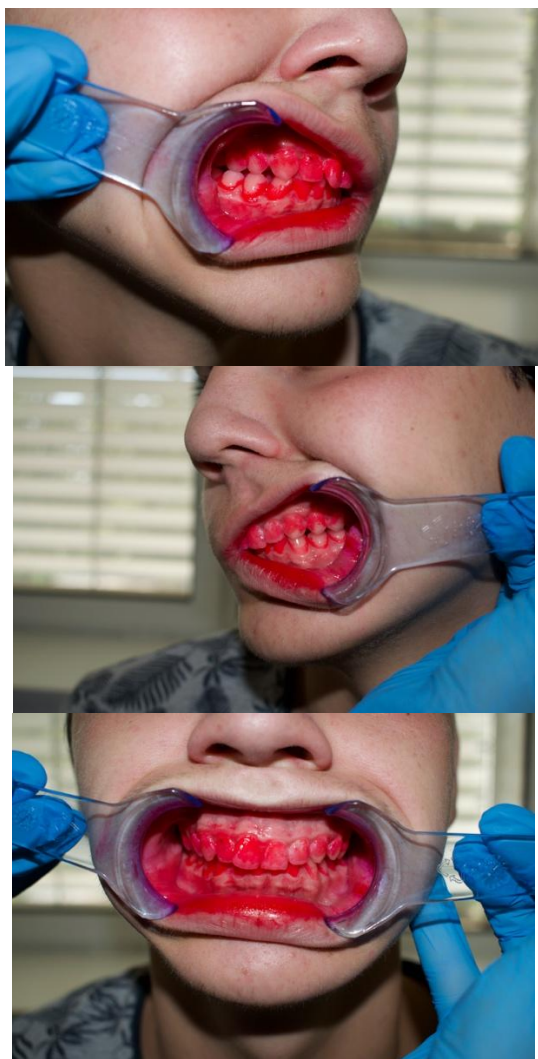
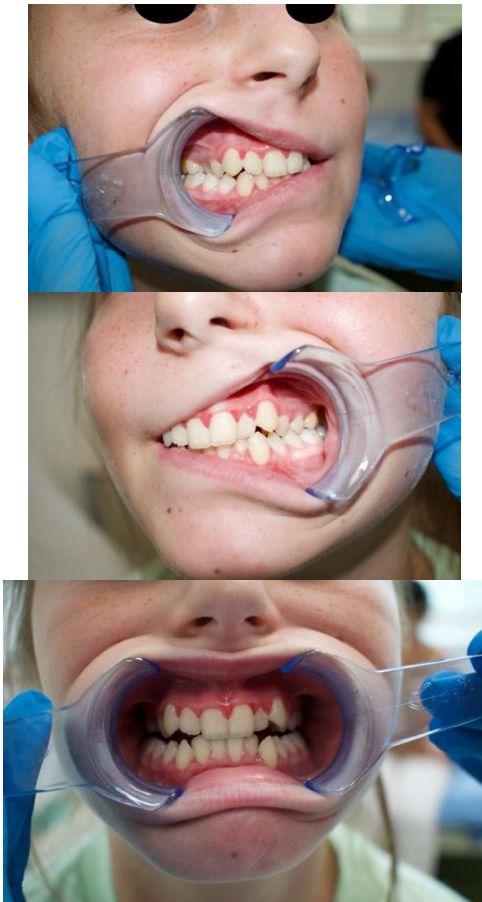


Figure 5. Disclosure of dental plaque

**Periodontal diagnosis: Plaque-induced gingivitis**

**3) Patient A. Ş. L., Age 12 years old  
General health diagnosis: Insulin-Dependent Diabetes Mellitus**

|                                    |                                                                                                                                                                                          |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Duration of diabetes</b>        | <b>11 years</b>                                                                                                                                                                          |
| <b>Numbers of hospitalizations</b> | <b>4</b>                                                                                                                                                                                 |
| <b>AP</b>                          | <b>Child born via cesarean section, VN=39 weeks, GN=2650g<br/>Type 1 Diabetes Mellitus since 7 months</b>                                                                                |
| <b>AHC</b>                         | <b>Mother 43 years old— Cardiac Malformation<br/>Father 43 years old – Apparently healthy<br/>Maternal grandfather- Type 2 Diabetes Mellitus<br/>Sister, Brother- Apparently Healthy</b> |
| <b>HbA1c</b>                       | <b>&gt;7%</b>                                                                                                                                                                            |

**Table. 4. Medical History of patient A.Ş.L****Figure 6. Intraoral clinical appearance****Figure 7. Disclosure of dental plaque****Periodontal diagnosis – superficial marginal periodontitis**

|            |      |
|------------|------|
| <b>IQH</b> | 3,8  |
| <b>GI</b>  | 3    |
| <b>PBI</b> | 2    |
| <b>PAC</b> | 2 mm |

**Table 5. Indices for patient A.Ş.L****RESULTS AND DISCUSSIONS**

In this study conducted on a group of 80 pediatric patients, aged between 4 and 18 years old, oral manifestations were monitored in patients with and without Insulin-Dependent Diabetes Mellitus (IDDM), with a particular focus on periodontal involvement. A significant percentage of the total group, namely 75% of the patients (n=60), presented clinical signs of periodontal disease. Among these, 35 were girls and 25 were boys, suggesting a slight predominance of periodontal involvement in females. This may be associated with hormonal changes or differing exposure to behavioral and biological risk factors during puberty.

Among the 60 patients with periodontal involvement, 30 were diagnosed with Insulin-Dependent Diabetes Mellitus, while the other 30 had no systemic disease.

Statistical analysis was performed using the EXCEL program from the MICROSOFT OFFICE suite, employing mathematical statistical techniques for processing the measurement data and generating appropriate graphical representations.

### Study Group

The statistical analysis of the data reveals the following aspects regarding the study group:

| Total number of cases – 80            | Cases | %   |
|---------------------------------------|-------|-----|
| Other medical conditions              | 20    | 25% |
| Subjective periodontal symptomatology | 60    | 75% |

**Table 6. Incidence of all cases according to diagnosis**

| Number of cases presenting periodontal symptomatology | Number of cases | %      |
|-------------------------------------------------------|-----------------|--------|
| General bacterial gingivitis                          | 50              | 83,33% |
| Superficial chronic marginal periodontitis            | 6               | 10%    |
| Other forms of periodontal disease                    | 4               | 6,66%  |

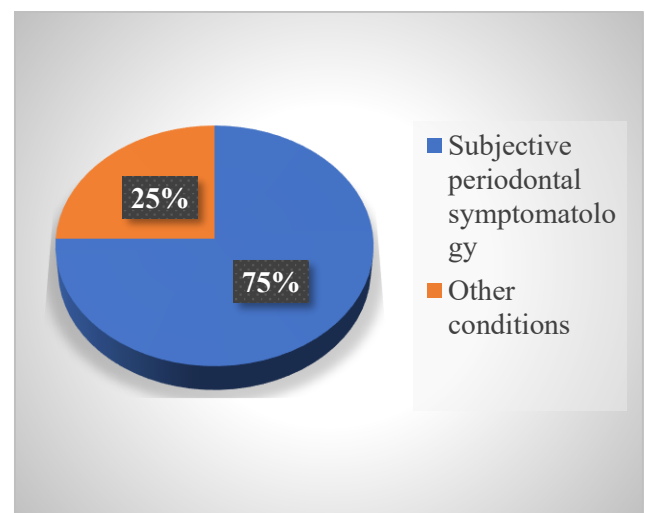
**Table 7. Incidence of periodontal symptomatology**

Out of the total number of cases (80), according to Table 8, 75% presented symptoms associated with periodontal disease. The highest proportion was represented by generalized bacterial gingivitis (50 cases – 83.33%), followed by superficial chronic marginal periodontitis, which was in progression due to local inflammatory factors (10%), and other forms of periodontal disease accounting for 6.66% (corresponding to 4 cases).

Furthermore, no advanced forms of periodontal involvement (such as deep chronic marginal periodontitis) were encountered during the study, as such conditions typically require a longer period of time for development and progression.

| Patient gender |        | Number of cases | %      |
|----------------|--------|-----------------|--------|
| Examined cases | Male   | 35              | 43,75% |
|                | Female | 45              | 56,25% |
| Total          |        | 80              |        |

**Table 8. Incidence of cases according to patients' gender**



**Figure 8. The incidence of periodontal diseases based on the studied group**

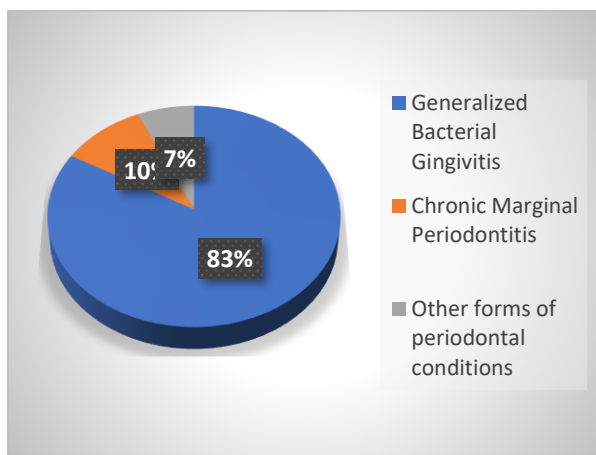


Figure 9. The incidence of periodontal disease based on the studied group

|                                       |                                        |    |     |
|---------------------------------------|----------------------------------------|----|-----|
| Subjective periodontal symptomatology | Patients with Type 1 Diabetes          | 30 | 50% |
|                                       | Patients without any general condition | 30 | 50% |
| Total                                 | 60                                     |    |     |

Table 9. Incidence of Subjective Periodontal Symptoms According to the Presence or Absence of General Health Impairment

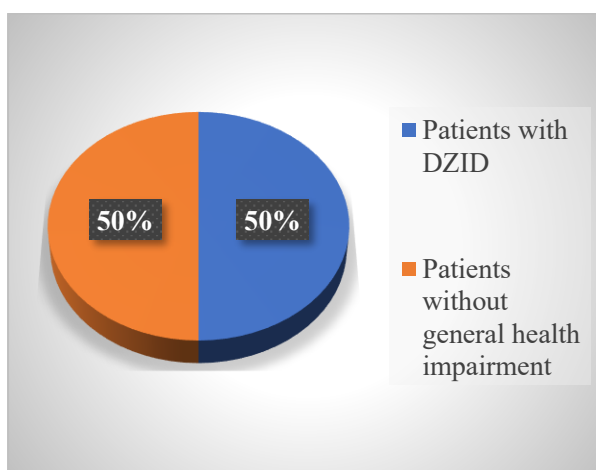


Figure 10. Subjective Periodontal Symptomatology According to the Presence or Absence of General Health Impairment

|                                       |        |    |        |
|---------------------------------------|--------|----|--------|
| Subjective periodontal symptomatology | Male   | 25 | 41,66% |
|                                       | Female | 35 | 58,33% |
| Total                                 | 60     |    |        |

Table 10. Incidence of Subjective Periodontal Symptoms According to patients' gender

Regarding gender distribution, the initially evaluated groups were balanced, with an approximately equal proportion (56.25% girls and 43.75% boys).

In children and adolescents, periodontal disease can present in various forms, ranging from simple gingival tissue involvement—most commonly gingivitis (83.33%)—to destruction of the periodontium, which in some cases can lead to tooth loss.

It is widely accepted that the most common form of marginal periodontal involvement in children and adolescents is gingivitis [7].

Epidemiological studies have shown that children, like adults, are also vulnerable to periodontal diseases, although with a lower prevalence [8].

Clinical observations indicate that the frequency of gingivitis is directly proportional to poor oral hygiene.

As for the distribution according to the sex of the examined subjects, among patients presenting subjective periodontal symptoms, the percentage of boys (41.66%) was lower than that of girls (58.33%), likely due to earlier onset of puberty in girls compared to boys.

Periodontal changes among subjects in the control group showed the following distribution:

The majority of cases in this group were represented by plaque-induced inflammatory conditions, specifically gingivitis (83.33%), followed by superficial

chronic periodontitis (10%), and other forms of periodontitis (6.66%).

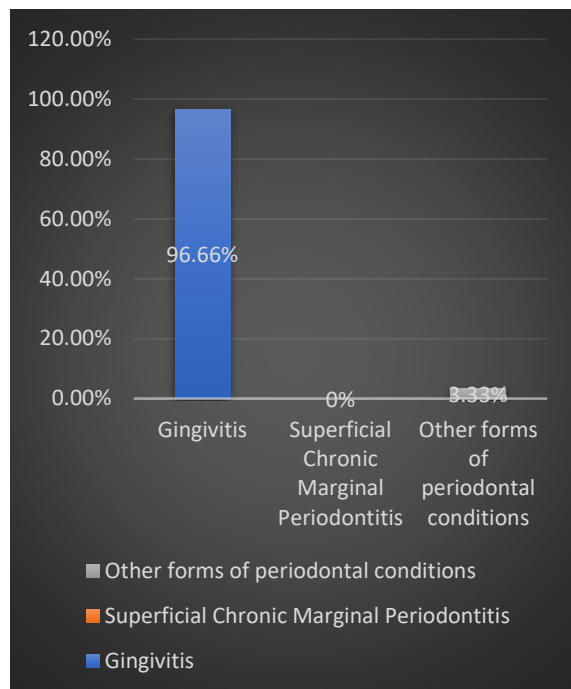


Figure 11. Proportion of Periodontal Conditions in the Control Group

### Periodontal Changes in the Group of Patients with Insulin-Dependent Diabetes Mellitus (IDDM):

The subjects in this group (N = 30) were divided into two subgroups:

1. **Group 1 – Control subgroup** (16 patients) (HbA1c > 7%)
2. **Group 2 – Active treatment subgroup** (14 patients) (HbA1c < 7%)

The incidence of periodontal conditions was as follows:

- **Gingivitis** – 79.06% (34 patients)
- **Superficial chronic marginal periodontitis** – 10.47% (4 patients)
- **Other forms of periodontal involvement** – 10.47% (5 patients)

| Diagnosis            | Number of cases |       | %     |
|----------------------|-----------------|-------|-------|
| Bacterial Gingivitis | 27              | G1:14 | 90%   |
|                      |                 | G2:13 |       |
|                      | 2               | G1:1  | 6.66% |

|                                            |    |       |       |
|--------------------------------------------|----|-------|-------|
| Superficial chronic marginal periodontitis |    | G2:1  |       |
| Other forms of periodontal involvements    | 1  | G1 :1 | 3,33% |
|                                            |    | G2 :0 |       |
| Total                                      | 30 |       |       |

Table 11. Incidence of Conditions in the Group of Patients with IDDM

This strong correlation between IDDM and periodontal disease supports findings from the literature, which indicate that poor metabolic control leads to changes in the supporting dental tissues. The mechanisms involved include altered gingival microcirculation, reduced neutrophil function, increased production of proinflammatory cytokines, and excessive accumulation of advanced glycation end products (AGEs) in the periodontium.

By comparison, patients without systemic conditions (n=30) exhibited a much lower prevalence of periodontal involvement, supporting the hypothesis that IDDM is an independent and significant risk factor for the early onset of periodontal disease.

The conducted study highlighted that the values of inflammation and gingival bleeding indices were significantly higher among children with poorly controlled Diabetes Mellitus (defined by glycated hemoglobin HbA1c > 7%).

According to the ADA (2024), indicators such as the Plaque Index (QH) and the Gingival Index (GI)—especially gingivitis and bone loss scores—are directly influenced by uncontrolled blood glucose levels, while regular dental interventions can reduce their severity and positively impact HbA1c levels [1].

Furthermore, Preshaw et. al. (2012) and Sanz et al. (2018) indicate, in their studies, a strong association between

elevated QH and GI indices and patients with poorly controlled diabetes (HbA1c > 7%) [4][5].

Carelli et. al. (2023) suggest the implementation of a continuous education program in oral and professional hygiene, periodontal monitoring, and a multidisciplinary approach of children with insulin-dependent diabetes mellitus (dentist/pedodontist, diabetologist) [8].

## CONCLUSIONS

Children with Insulin-Dependent Diabetes Mellitus (IDDM) present an increased risk of periodontal tissue involvement, particularly in cases of poorly controlled diabetes.

The values of the Plaque Index (QH), Gingival Inflammation Index, and Gingival Bleeding Index were higher among diabetic children compared to healthy children with no systemic conditions.

Among diabetic children, these indices especially the gingival inflammation and bleeding scores were significantly higher in those with poorly controlled IDDM.

To improve the oral health and, consequently, the quality of life of children with IDDM, the implementation of prevention programs and oral health education at both community and individual levels is essential.

## Acknowledgements

The authors would like to thank Prof. Dr. Habil. Toma Vasilica for the support and constructive comments and also to the Prof. Dr. Trandafir Laura Mihaela for giving the permission to examine the patients from Nutrition and Dietetic Clinic of Emergency for Children Hospital Sf. Maria from Iași.

## REFERENCES

1. American Diabetes Association. Standards of Medical Care in Diabetes—2024. Diabetes Care. 2024;47(Supplement 1):S1-S211.
2. Lalla E, Papapanou PN. Diabetes mellitus and periodontitis: a tale of two common interrelated diseases. Nat Rev Endocrinol. 2011;7(12):738-748.
3. Mealey BL, Ocampo GL. Diabetes mellitus and periodontal disease. Periodontol 2000. 2007;44(1):127-153.
4. Preshaw PM, Alba AL, Herrera D, et al. Periodontitis and diabetes: a two-way relationship. Diabetologia. 2012;55(1):21-31.
5. Sanz M, Ceriello A, Buysschaert M, et al. Scientific evidence on the links between periodontal diseases and diabetes: Consensus report and guidelines of the Joint Workshop on Periodontal Diseases and Diabetes by the International Diabetes Federation and the European Federation of Periodontology. Diabetes Res Clin Pract. 2018; 137:231-241.
6. Al-Maskari AY, Al-Maskari MY, Al-Sudairy S. Oral manifestations and complications of diabetes mellitus: a review. Sultan Qaboos Univ Med J. 2011; 11(2):179-186.
7. Wei, J. J., Chang, C. R., Pan, Y. P., Yu, N., & Zhao, H. Effect of non-surgical periodontal therapy on glycemic control and the level of serum il-6 in type 2 diabetic patients with chronic periodontitis. Zhonghua Kou Qiang Yi Xue Za Zhi, 2011; 46(2):70-74.
8. Carelli M., et. al. Oral Microbiota in Children and Adolescents with Type 1 Diabetes Mellitus: Novel Insights into the Pathogenesis of Dental and Periodontal Disease, Microorganisms 2023; 11(3), 668.

9. Boulton, A. J. M., et al. Neuropathy and the diabetic foot. *The Lancet Diabetes & Endocrinology*, 2018; 6(10):828-838.
10. Mârțu S. et. al. Ghid practic de propedeutică parodontală Ed. Pim, Iasi, 2010
11. Page RC, Bowen T. Allman L. et al. Prepubertal periodontitis. I. Definition of a clinical disease entity. *J Periodontol* 1983; 54:257-271.
12. Hsu Y-T, Nair M, Angelov N, Lalla E, Lee C-T. Impact of diabetes on clinical periodontal outcomes following non-surgical periodontal therapy. *J Clin Periodontol*. 2019; 46: 206–217.
13. Silva-Boghossian, C. M., Orrico, S. R., Goncalves, D., Correa, F. O., & Colombo, A. P. Microbiological changes after periodontal therapy in diabetic patients with inadequate metabolic control. *Brazilian Oral Research*, 2014; 28(1):1–9.
14. Rodríguez-Archilla, Alberto, & Piedra-Rosales, Claudia. Candida species oral detection and infection in patients with diabetes mellitus: a meta-analysis. *Iberoamerican Journal of Medicine*, 2021; 3(2):115-121.
15. Badahdah A., Bahanan L., Barnawi R., Alghamdi A., Banjar A. Outcomes of Nonsurgical Periodontal Therapy in Gingivitis and Periodontitis Patients Treated by Senior Dental Students. *International Journal of Dental Hygiene*, 2024; 23(2):374-383.
16. Kıran, M., Arpak, N., Ünsal, E., & Erdoğan, M. F. The effect of improved periodontal health on metabolic control in type 2 diabetes mellitus. *Journal of Clinical Periodontology*, 2005; 32(3): 266–272.
17. Koch, G., Poulsen, S., Espelid, I., & Haubek, D. (Eds.) (2017). *Pediatric Dentistry: A Clinical Approach*, 3rd Edition. (Third Edition ed.) Wiley-Blackwell.