

# Antibiotic Prescription for Dental Procedures in Type 1 Diabetic Children

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## ABSTRACT

In diabetic patients, maintaining blood glucose levels as close to normal as possible is an objective in dental management especially in pediatric ones. Patients with poorly controlled diabetes are at greater risk of developing infections. Therefore, the prescription of antibiotics may be necessary for some dental procedures.

**Aim:** The aim is to optimize the benefit and minimize the risk of antibiotics in dental treatments performed in diabetic children.

**Materials and methods:** A cross-sectional approach was conducted on 155 type 1 diabetic children (72 controlled and 83 uncontrolled). The types of dental acts held for the study were pulpotomies, pulpectomies, pediatric crowns, scaling, and extraction. For the balanced diabetic patients, no antibiotics were prescribed except for infected teeth. In the unbalanced diabetic group, for the acts causing bleeding, prophylactic antibiotics were administered. In presence of dental infection, antibiotics were administered for at least 5 days.

**Results:** The analysis of data was carried out using Statistical Package for the Social Sciences Computer Software (SPSS 21.0, Inc., Chicago, Illinois, USA). A probability value of  $<0.05$  was regarded as statistically significant. Around 126 acts in the balanced group and 145 in the unbalanced ones were performed. In balanced diabetic children, 125 successes and one failure were noted. In the unbalanced group, 142 successes and three failures were recorded. The comparison between variables did not show any statistical significance ( $p$ -value = 0.382).

**Conclusion:** This study demonstrated that working with diabetic young patients is possible and safe as long as some measures are considered. It is crucial to identify the dental acts that necessitate antibiotics administration and to differentiate between balanced and unbalanced diabetic children for the same dental procedure.

**Keywords:** Antibiotics, Antibiotic prophylaxis, Diabetes mellitus type 1, Diabetic child, Pediatric dentistry.

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## INTRODUCTION

Type 1 diabetes is a life-threatening, autoimmune disease that strikes children and adults. Maintaining blood glucose levels as close to normal as possible in diabetic patients is an objective in dental management, especially in pediatric ones.<sup>1,2</sup> Patients with poorly controlled diabetes are at greater risk of developing infections and may demonstrate delayed wound healing.<sup>3</sup>

Although many treatments are similar to those recommended for patients without diabetes, managing diabetic patients does require rigorous follow-up and large attention to prevention.<sup>4</sup>

Therefore, several considerations should be kept in mind. In some cases, the prescription of antibiotics may be necessary.

Some authors declared that antibiotic prescription in dentistry is considered to constitute approximately 7–10% of global antibiotic prescriptions, and it is estimated that 80% of these prescriptions are inappropriate across dental care.<sup>5–7</sup>

Antibiotics are extensively prescribed in dentistry for both preventive and therapeutic purposes. Excessive use can induce resistant bacterial strains. The increasing resistance problems of recent years are probably related to the overuse or misuse of broad-spectrum agents.<sup>8–10</sup>

Several studies highlighted the abuse of antibiotics during the treatment of pediatric patients leading to antimicrobial resistance. The dental profession is no exception; there is rising evidence that pedodontists are misusing antibiotics.<sup>11,12</sup>

Antibiotics are not an alternative to dental intervention; they are adjuncts.<sup>6,7</sup> Antibiotics are recommended in dentistry for

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immunocompromised patients when evident signs of systemic infection and if the symptoms of infection progress rapidly.<sup>13</sup>

The aim of the present study was to demonstrate that dental treatment in pediatric diabetic patients can be done safely with an optimal antibiotic prescription when indicated. Therefore, the objective was to optimize the benefit and minimize the risk of antibiotics in diabetic children.

## MATERIALS AND METHODS

A cross-sectional approach was conducted on type 1 diabetic children in the Department of Pediatric Dentistry at the Lebanese University in Beirut, Lebanon. The children are from the Chronic Care Center (CCC)\*. The sample consisted of 155 children aged between 7 and 12 years old, divided into 72 controlled diabetic children

(32 females and 40 males) and 83 uncontrolled ones (40 females and 43 males). In this study, diabetic children are considered balanced when their hemoglobin A 1c (HbA1c)  $\leq 7$  and unbalanced when their HbA1c  $> 7$ .

The blood glucose level was tested right before the dental procedure; only the patients having a blood glucose level between 70 and 300 mg/dL could undergo the treatment.

The types of dental acts held for the study were pulpotomies, pulpectomies, pediatric crowns, scaling, and extraction. They required local anesthesia and were carried out under 2% lignocaine with 1:200000 epinephrine.

For the balanced diabetic patients, no antibiotics were prescribed for the treatments cited above except for infected teeth where antibiotic therapy for at least 5 days was mandatory (Augmentin<sup>®</sup> 35–50 mg/kg/day).

In the unbalanced diabetic group, for the acts causing bleeding, prophylactic antibiotics were prescribed at a single dose of Augmentin (50 mg/kg) 1 hour before treatment. In presence of dental infection, antibiotics were administered for at least 5 days (Augmentin 35–50 mg/kg).

The postoperative recalls were at 1 week, 1 month, and 3 months.

The dental treatment was considered a failure when the tooth showed at least one of the following symptoms:

- Persistent pain on percussion.
- Swelling.
- Abnormal tooth mobility.
- Abscess.
- Sinus tract.

An informed consent form was signed by the children's parents or guardians. The ethics committee of the Faculty of Medicine at the Lebanese University approved the study protocol [Comité Univesitaire d'Ethique de Recherche (#CUER14 -2020)]

The analysis of data was carried out using:

- A *p*-value  $\leq 0.05$  was considered significant.

\*CCC is a Lebanese private non-lucrative institution with a multidisciplinary medical team for preventing and monitoring certain chronic childhood diseases including type 1 diabetes mellitus (T1DM).

## RESULTS

The analysis of data was carried out using SPSS 21.0, Inc., Chicago, IL, USA. The Chi-squared test ( $X^2$  test) and Fisher's exact test were used to determine if there is a significant relationship between categorical variables. A probability value of  $<0.05$  was regarded as statistically significant.

A total of 271 dental acts causing normal bleeding were done in diabetic children, 126 acts in the balanced group and 145 in the unbalanced one.

Table 1 shows that in the female-controlled group (#32), 22 pulpotomies, 26 pediatric crowns, and two scaling procedures were performed without antibiotic administration. Prophylactic antibiotic was prescribed for six extractions of infected teeth while curative antibiotic was for at least 5 days for two pulpectomies in permanent teeth.

In the male group (#40) the dental acts performed were 26 pulpotomies, 29 pediatric crowns, three scaling procedures, 10 extractions, and 0 pulpectomies with the same antibiotic therapy protocol adopted in the female group.

In the females' unbalanced group (#40), 28 pulpotomies, 32 pediatric crowns, one scaling, and nine teeth extractions were performed while in males the numbers were 30, 37, 0, and eight, respectively. Prophylactic antibiotic therapy was administered in 128 dental acts. For 17 inflamed or infected cases, a course of antibiotics for at least 5 days was prescribed. Table 2 shows that in total dental acts in balanced diabetic children, 125 successes and one failure were noted. In the unbalanced group, 142 successes and three failures were recorded.

## DISCUSSION

In diabetic children, the primary concern after dental treatment is the risk of infection occurrence. Dentists should understand that most dental problems require more attention and anticipation of infection risk. Usually, the treatment of the cause prevents the infection.<sup>14–18</sup>

In fact, deep knowledge about the dental management of diabetic children helps make treatments as problem-free as possible, especially since dental infection in pediatric patients is

**Table 1:** Antibiotics administration in diabetic children according to the type of dental act

	Balanced diabetic children (HbA1c $\leq 7$ )						Unbalanced diabetic children (HbA1c $> 7$ )					
	Antibiotics	Female #32	Failure	Male #40	Failure	Total	Antibiotics	Female #40	Failure	Male #43	Failure	Total
Pulpotomy	None	22	1	26	0	48	Prophylactic	28	1	30	2	58
Pediatric crown	None	26	0	29	0	55	Prophylactic	32	0	37	0	69
Scaling	None	2	0	3	0	5	Prophylactic	1	0	0	0	1
Extraction	Prophylactic	6	0	10	0	16	Curative	9	0	8	0	17
Pulpectomy on permanent teeth	Curative	2		0		2	N/A	0		0	0	0
Total		58		68	0	126		70		75		145

**Table 2:** Comparison of the success and failure rates in dental treatments between balanced and unbalanced diabetic children

Children	Success	Failure	Total	Percentage of failure	<i>p</i> -value
Balanced diabetic	125	1	126	0.79%	0.382
Unbalanced diabetic	142	3	145	2.06%	
Total	267	4	271	1.47%	

known to progress rapidly within a short period. It is potentially fatal in diabetic children as they could present impaired immunity.<sup>19</sup>

After an oral procedure, microorganisms disseminate very fast into the bloodstream and reach vital organs such as the lungs, heart, and peripheral blood capillary system from the infected site.<sup>20</sup> Therefore, in high-risk patients, some important measures should be taken before invasive dental procedures.

In the present study, in balanced diabetic children from 126 dental acts, 108 have been performed without antibiotic prescription when treated for pulpotomy, pediatric crown, and scaling. Babatzia<sup>21</sup> stated that children with poor glycemic control might be regarded as having a higher risk for oral disease in comparison with children with well-controlled T1DM.

Despite the completion of the 108 acts without antimicrobial coverage, one failure was recorded after pulpotomy, in females and might be due to misdiagnosis (Table 1). Prophylactic antibiotics were prescribed in 16 primary teeth extractions. According to the American Academy of Pediatric Dentistry (2021), antibiotic therapy is not indicated if the dental infection is limited to the pulp or the immediately surrounding tissue.<sup>12</sup> Moreover, Cahill et al.<sup>22</sup> suggested in their meta-analysis that bacteremia in patients having dental treatment could be reduced by prophylactic antibiotics.

In the present study, as all patients are diabetic, two types of antibiotic administration have been applied, the prophylactic and the curative. Although international guidelines recommend restricting and decreasing antibiotic administration in order to suppress antibiotic resistance, the prophylactic antibiotic was prescribed in both balanced and unbalanced patients according to the dental procedure. Bakhsh et al.<sup>13</sup> declared that the European and American guidelines insist on the importance of antibiotic prophylaxis before invasive dental procedures in patients with immunosuppressive conditions.

For at least 5 days, a full course of antibiotics was given in two cases of pulpectomy on infected permanent teeth. No complication or failure was reported. When prescribing to children, it is important to respect certain measures such as the dosage and the duration of the antibiotic therapy to improve treatment outcomes. It is important to educate caregivers on the uses and potential side effects of antibiotics on one hand. On the contrary, it is mandatory to explain the risk of an incorrect dosing regimen and/or treatment duration.<sup>11</sup>

In the unbalanced patients' group, despite the prescription of prophylactic antibiotics in 128 dental acts to prevent any risk of postoperative infection, three failures were reported in pulpotomy (Table 1). Many reasons can be implicated, such as the adventurous pulp anatomy in primary teeth, a misdiagnosis of the dental status, or impaired immunity in unbalanced diabetic children.<sup>19,23-26</sup>

Around 17 extractions needed curative antibiotic therapy for 1 week to ensure antimicrobial coverage during the healing process (Table 1). Knowing that dental extraction presents an open wound subject to infectious complications, an essential antibacterial cover is started 24 hours before the intervention and is prolonged over 6 days. Patients with impaired immunity are more prone to infection than healthy persons.<sup>27</sup>

Okoje et al.<sup>28</sup> declared that patients with poorly controlled diabetes are at high risk of developing oral complications and show delayed wound healing.

In diabetic children, dentists should understand that most dental problems require more attention and anticipation of infection risk.<sup>14-18</sup>

As none of the patients presented an allergy to penicillin, the chosen antibiotic was amoxicillin combined with clavulanate at a dosage between 35 and 50 mg/kg/day. Indeed, both amoxicillin and clavulanate show good oral absorption.<sup>29</sup> According to Segura-Egea et al.,<sup>25</sup> amoxicillin has good characteristics to be the drug of choice for orofacial infections; as it is readily absorbed, can be taken with food, and is capable to resist gastric acidity.

Amoxicillin-clavulanic acid combination is amongst the most preferred by dentists globally for the prevention of postoperative infection.<sup>30</sup>

In Table 2, no significant association was found between the variables in balanced and unbalanced groups ( $p = 0.382$ ). Despite the administration of antibiotics for unbalanced patients, 2.06% of failures were recorded, of which 0.79% were in the balanced group. The latter concurs that an unbalanced diabetic person is more prone to infectious complications even with antimicrobial coverage, which coordinates with many authors' declarations.<sup>14,15,18</sup>

After displaying the results and discussing different ways of antibiotic administration according to the type of diabetes mellitus and the kind of dental procedure, a summarizing table was elaborated (Table 3). It is important to mention that the choice of the antibiotic and its appropriate dosage for prophylactic and curative therapies will be decided according to each patient in collaboration with his physician. Steady communication with physicians is important for treating safely patients with diabetes; dentists must be informed about their glycemic control to help them maintain good oral health.

## CONCLUSION

This study demonstrated that working with diabetic young patients is possible and safe as long as some measures are considered. Practitioners must be aware and ready to deal with potential

**Table 3:** Antibiotic therapy in dental management for type 1 diabetic children

Balanced $70 \leq (\text{hemo glucose test})$ $\text{HGT} \leq 300 + \text{HbA1C} \leq 7.5$	No antibiotic	Prophylactic (50 mg/kg 1 dose 1 hour before treatment)	Curative (35-50 mg/kg 2 or 3 times daily for at least 5 days)
	<ul style="list-style-type: none"> <li>Restorative dentistry</li> <li>Pulpotomy</li> <li>Pediatric crown</li> <li>Scaling</li> <li>Extraction</li> </ul>	<ul style="list-style-type: none"> <li>Pulpectomy.</li> <li>Chronic infection.</li> <li>Extraction.</li> </ul>	<ul style="list-style-type: none"> <li>Cellulites.</li> <li>Pulpectomy in necrotic permanent teeth.</li> </ul>
Unbalanced $70 \leq \text{HGT} \leq 300 + \text{HbA1c} > 7.5$	<ul style="list-style-type: none"> <li>Any dental act without bleeding</li> </ul>	<ul style="list-style-type: none"> <li>Pulpotomy.</li> <li>Dental acts causing bleeding.</li> </ul>	<ul style="list-style-type: none"> <li>Dental abscess.</li> <li>Pulpectomy in permanent teeth.</li> <li>Cellulitis.</li> <li>Extraction.</li> </ul>

No significant association was found between variables

problems. It is crucial to identify the dental acts that necessitate antibiotic administration and to differentiate between balanced and unbalanced diabetic children.

Balanced diabetic children can be considered healthy patients, but prophylactic antibiotics are recommended for invasive dental acts without infection. On the contrary, few dental acts do not impose any prescription of antibiotics for unbalanced patients. Most of the time, prophylactic or curative antimicrobial therapy is recommended to avoid complications.

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