

## The influence of oral health on glycemic control, under interdisciplinary guidance

### *A influência da saúde bucal no controle glicêmico, sob orientação interdisciplinar*

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**ABSTRACT:** Glycemic control is essential not only for diabetic patients, but also for any other patient who watches over his general well-being. Therefore, knowing that good oral health interferes positively in the former mentioned control is something that favors the patient, as long as he acquires such knowledge during his medical and dental appointments. This is a cross-sectional quantitative study, which aimed, through a questionnaire, to evaluate the knowledge of 196 patients of the project entitled XVI Antonio Prudente - Health Fair 2016 on the influence of oral health on glycemic control, as well as to verify the medical and dental orientation given to these patients about this influence and how to relate the professional orientation with the patient's blood glucose. Few interviewees considered oral health as something important for glycemic control because the minority of patients is jointly advised by doctors and dentists about the need for multidisciplinary diabetic care in order to better control the disease. It was concluded that it is extremely important to have multidisciplinary public and private health services for diabetics to educate them in self-care, to generate better communication among professionals and to guarantee better quality of life for patients after effective control of capillary glycemia.

**Keywords:** Blood glucose; Oral health; Patient care team.

**RESUMO:** O controle glicêmico é essencial não só para o paciente diabético, mas também para qualquer outro paciente que ze pelo seu bem-estar geral. Saber que uma boa saúde bucal interfere positivamente nesse controle favorece o paciente, desde que ele adquira esse conhecimento durante seus atendimentos médicos e odontológicos. Esse estudo é do tipo quantitativo transversal e por meio de um questionário avaliou-se o conhecimento de 196 pacientes do XVI Projeto Antonio Prudente (Feira de Saúde 2016) sobre a influência da saúde bucal no controle glicêmico, além de verificar a orientação médica e odontológica aos pacientes sobre essa influência e relacionar o tipo de orientação profissional com a glicemia deles. Poucos entrevistados consideraram a saúde bucal importante para controlar a glicemia, pelo fato de que a minoria dos pacientes é orientada em conjunto pelos médicos e dentistas sobre a necessidade do cuidado da saúde como um todo. Concluiu-se que é extremamente importante ter serviços de saúde públicos e privados multidisciplinares aos diabéticos para educá-los no autocuidado, gerar melhor comunicação entre os profissionais e garantir melhor qualidade de vida aos pacientes após controle eficaz da glicemia capilar.

**Descritores:** Glicemia; Saúde bucal; Equipe de assistência ao paciente.

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## INTRODUCTION

Diabetes mellitus is a multifactorial chronic disease characterized by metabolic disorders due to an exposure to hyperglycemia, for there is resistance to endogenous insulin or insufficient production of it<sup>1</sup>. According to data from the International Diabetes Federation (IDF) in 2014, a contingent of 387 million people worldwide has the disease, a global prevalence of 8.3%, and there is an expectation of 53% increase by 2035. Of this total, it is estimated that 11.9 million are Brazilians and, by 2035, 19.2 million people in Brazil will have the disease<sup>2</sup>.

In order to avoid complications from exposure to hyperglycemia, the patient needs to be educated about lifestyle changes and factors that interfere with the disease control. Without such information, the patient cannot understand the importance of correct treatment and its adherence becomes lower. In order to improve the patient with diabetes, socioeconomic conditions and cultural aspects must be considered, and not only the individual and his family alone. Another important point is multidisciplinary treatment, which observes details that are not in the medical field, but could resolve a persistent hyperglycemia.

Among the complications of diabetes, periodontal disease is known for being one of the six most prevalent complications and is considered relevant for being able to increase its frequency and progression<sup>3</sup>. In parallel, from the associations observed between oral health condition and chronic and multifactorial systemic pathologies, periodontal disease is the one that is linked the most to diabetes mellitus<sup>4</sup>. It cannot be forgotten that it is not only diabetes that is related to dental diseases, since the inflammatory and infectious process, predominantly anaerobic gram-negative, is also related to other systemic disorders such as strokes, pulmonary infections, gastrointestinal disorders and birth of underweight babies and / or premature babies<sup>5</sup>.

The treatment of periodontitis in diabetic patients positively interferes with disease markers, such as reduced glycemic index, pro-inflammatory cytokines, matrix metalloproteinases and C-reactive protein<sup>6</sup>. It is well documented that acute infections and inflammatory conditions increase both serum glucose levels and the use of insulin, complicating, therefore, the metabolic control of diabetes. Thus, attention to dental treatment should be considered as an adjunct to the treatment of systemic diseases, since, as already mentioned, chronic oral infection is related to several other pathologies, which can change the course of the disease control and follow-up<sup>7</sup>. When the periodontal condition of patients undergoing hemodialysis was treated, there was also a significant improvement in some of the inflammatory indices such as creatine, hemoglobin and hematocrit when compared before and after treatment<sup>8</sup>.

A meta-analysis showed that periodontal treatment led to a 0.4% reduction in HbA1c, glycated hemoglobin. This may seem insignificant, but the authors of the review point out that, so far, even a slight reduction in HbA1c can decrease the risk of microvascular complications. Therefore, a reduction of this magnitude can lead to a reduction of population mortality up to 10%<sup>9</sup>.

It is known that the low adherence to the treatment and the carelessness concerning changes of habits prevents about 50% of individuals who have chronic diseases, such as diabetes, from progressing well in the context of the disease<sup>10</sup>. This happens due to the fact that the patient often does not understand the importance of correct treatment, nor the serious consequences that negligence takes, and the factors that prevent the improvement of his health. The doctor, knowing better all aspects that positively and negatively interfere in the glycemic rate, such as periodontal disease, is able to guide the patient and contribute to his well-being<sup>9</sup>.

Thus, the objective of this research is to analyze the knowledge of 196 patients, participating in a university health fair, about the influence of oral health on glycemic control. In addition, we sought to assess whether doctors and dentists do advise patients on this issue.

## MATERIAL AND METHODS

The study was executed in the city of *Mogi das Cruzes*, located in the *Alto Tietê* region of the state of São Paulo, is approximately 50 kilometers from the city of São Paulo and has an estimated population of 433,901 inhabitants<sup>11</sup>. The city's primary health care network has twenty-one Primary Care Units (UBS) and twelve Family Medicine Units (USF). Twenty UBSs and five USFs have dental care.

This is a cross-sectional quantitative study, carried out in the XVI Antonio Prudente Project - Health Fair of the Antonio Prudente Academic Center (C.A.A.P.), which is a supplementary organ of the Medicine course at the University of Mogi das Cruzes. This annual project is organized by C.A.A.P. and it has about 350 volunteer students and health professionals who carry out an average of 2000 visits from medical, psychological, nutritional, sports, biomedical or dental care.

The study sample consisted of 196 patients from the XVI Antonio Prudente Project who fit the following pre-established inclusion criteria: being over 18 and having performed the capillary blood glucose test in the screening sector of the health fair. The data were obtained through an approach to the patient followed by a brief explanation of the researchers' proposal to allow the interviewee to have the necessary freedom and spontaneity to enrich the investigation. The interviews were conducted in the waiting rooms of the offices during the two days of the health fair.

The research instrument was a questionnaire

composed of data, identifying the subjects and guiding questions regarding the provision of information about the influence of oral health on glycemic control by doctors and dentists to their patients. In the applied questionnaire, there were also questions to assess whether the patient had bleeding gums while using dental floss, whether he was evaluated by doctors and dentists frequently, whether he considered his oral and overall general health in good conditions, what is the importance of good health oral care for a diabetic patient, among others. In addition to these questions, the researchers collected the capillary glycemia value from the patients' record. The data were analyzed and presented using measures of central tendency and dispersion and the chi-square statistical test was also performed.

The American Diabetes Association<sup>12</sup> defined the measure of capillary blood glucose reference for the diagnosis of diabetes mellitus (Table 1). However, the patients at the university health fair were not fasting during the capillary blood glucose test, neither did they mention whether they were using insulin or another medication, and the intention of this research was not to diagnose the disease

in patients. Thus, in this study, capillary blood glucose values above 140 mg/dl were classified as hyperglycemia (first change in blood glucose level), since patients were not fasting and there was an intention to detect any changes in blood sugar level, not necessarily diabetes mellitus.

It is noteworthy that, on the day of the interview, it was not possible to collect data on fasting blood glucose from patients or access medical records to determine if they are diagnosed with *Diabetes Mellitus* and whether or not they use insulin or any oral medication that lowers blood glucose. Therefore, the calculation for the prevalence of hyperglycemic patients in multiprofessional care may have been impaired.

The work meets the fundamental requirements of research ethics (Conselho Nacional de Saúde, 1996). All patients signed a consent form. The research project was submitted for analysis by the Research Ethics Committee Involving Human Beings at the University of Mogi das Cruzes, and approved under opinion No. 1,696,531 in August 2016. This research was not funded and did not involve any conflict of interest.

**Table 1** - Plasma glucose values for the diagnosis of diabetes mellitus and its preclinical problems

Group	Fasting (Minimum 8 hours)	2h after 75g of glucose	Random blood glucose levels
Normal	<100mg/dl	<140 mg/dl	-
Pre Diabetes	100-125 mg/dl	140-199 mg/dl	-
Diabetes Mellitus	≥ 126 mg/dl	≥ 200 mg/dl	≥200 with polydipsia, unexplained weight loss

Source: American Diabetes Association (2017)

## RESULTS

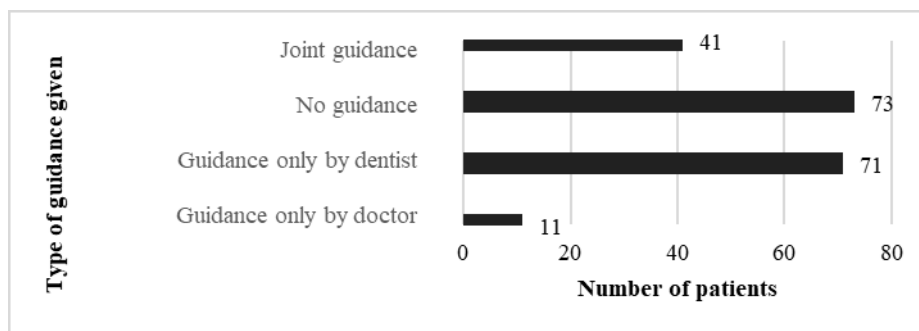
Of the 196 patients at the 2016 Health Fair in the city of Mogi das Cruzes, 65 of them (33.1%) were male and 131 (66.9%) were female. The ages ranged from 18 to 77 years, providing an average age of 42 years (SD ± 7.07 years).

Of the 65 men in the sample, the mean age of this group was 43.4 years and that of capillary blood glucose was 105.5 mg / dl, 6 men being hyperglycemic. As for the group of 131 women, the mean age was 41.3 years and the mean blood glucose was 100.6 mg/dl, 9 of those women having hyperglycemia. Thus, it was noted that the prevalence of hyperglycemics in the sample was 7.7%, being 9.2% in males and 6.9% in females, with no statistically significant difference ( $p=0.51$ ). Among patients considered hyperglycemic, the mean blood glucose was 226.2 mg/dl (SD ± 72.25).

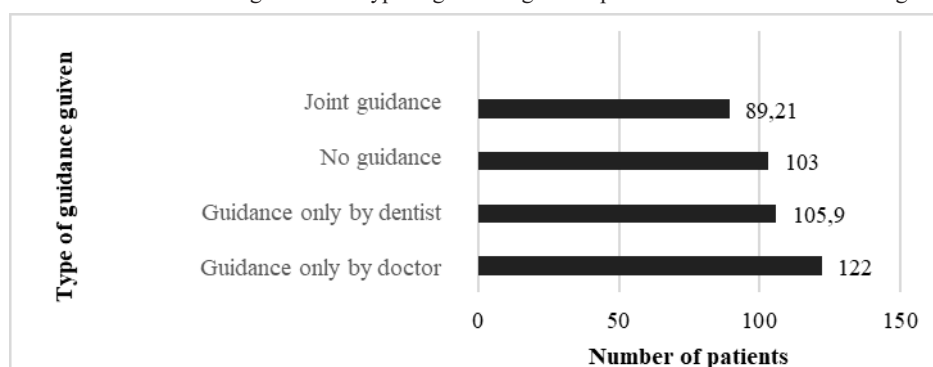
In the questionnaire applied, there were questions to assess whether the dentist and doctor of the interviewed patients advised them about the need to have good oral health to assist in glycemic control. The sample was divided

into four large groups according to the type of guidance they received: only by their doctor, only by their dentist, no guidance or guidance jointly by both professionals. Graphic 1 shows that the minority of patients received simultaneous instructions from the multidisciplinary team regarding the need for comprehensive care for better success in glycemic control. A significant part of the sample (37%) did not receive any information about the influence of oral health on glycemic control, neither by a doctor nor by dentists.

Graph 2 shows that the multidisciplinary and comprehensive work of the dentist with the doctor in providing the patient with adequate guidance results, in general, in a lower glycemic mean (89.21 mg/dl), in the group that never received guidance, the glycemic mean was 105.9 mg/dl, the difference between the mean of the two groups was statistically significant ( $p=0.034$ ). Among those who received guidance from the doctor and dentist, nobody was classified as having hyperglycemia, which means they all had a blood glucose level below 140 mg/dl. However, in the group that replied that nobody ever informed them about the importance of oral health in glycemic control, 6 (six) were classified as hyperglycemic, and the mean blood glucose among them was 220 mg/dl.

**Graphic 1** - Comparison between the number of patients and the type of guidance given to them at the Health Fair in Mogi das Cruzes (SP), 2016

Source: own elaboration

**Graph 2** - Comparison between mean blood glucose and type of guidance given to patients at the Health Fair in Mogi das Cruzes (SP), 2016

Source: own elaboration.

When analyzing the data on the oral health condition of the patients in the sample, it was noted that 132 of them (67.3%) use dental floss. Within this group that flosses frequently, of the 50 who have gingival bleeding during the process, 4 were hyperglycemic (8%), whereas of the 82 who did not bleed with flossing, 6 were hyperglycemic (7.3%).

In the entire sample, 69 patients (35.2%) stated that they have gingival bleeding, and 15 patients (22%) in this group are widely advised by the doctor and dentist about

the relationship of good oral and general health, to the point that 34 patients (49%) receive guidance from only one type of health professional and 20 patients (29%) receive no guidance about information. In the statistical analysis of the data in table 2, in which gingival bleeding and patient education were related to the influence of good oral health on general health, by doctors and dentists together,  $RR=1.05$  ( $x^2=0.04$ ;  $p<0.9$ ).

**Table 2** - Relationship between gingival bleeding and patient education through the medical and dental team together

		Gingival bleeding				X <sup>2</sup> =0,04 p<0,9
		Yes		No		
		n	%	n	%	
Education through doctors and dentists together about good oral health influencing general health	Yes	15	7,65	26	13,26	41
	No	54	27,55	101	51,53	155
Total		69	35,2	127	64,8	196

Source: own elaboration.

Still, on the 69 patients who have gingival bleeding, which means that they have a sick gum, 36 patients (52%) believe they have good or very good oral health.

Regarding the assessment of patients' knowledge in this research on the integration of oral health with general health in this study, 177 interviewees (90.3%) believe that

the integration of medical and dental care is important or very important. However, only 76 respondents (38.7%) consider that oral health is specifically important to help control capillary glycemia in a patient with *Diabetes Mellitus*. Of the patients who have this opinion, 62% received guidance from at least one health professional who

stated the issue of health being treated as a whole, and 65% stated that they do not have gingival bleeding.

Now, about the 15 hyperglycemic patients in the sample, 7 (46.6%) of them have gingival bleeding, none received guidance from the medical and dental teams together, 9 (60%) received guidance from a professional health team, being it medical or dental, and 6 (40%) did not receive guidance from any professional health team. It is important to note that 4 (26%) patients in this group reported that they never go to the doctor responsible for hyperglycemia and another 3 (20%) patients never go to the dentist. Only 4 (26.6%) patients believe that good oral health can affect the control of capillary blood glucose, and of these, 3 patients received this information during medical or dental consultations.

## DISCUSSION

From the 20th century onwards, there was a fragmentation of medical work. As a consequence, specializations have considerably reduced the comprehensive clinical performance of each specialist physician. This has made patients, over the years, get used to consultations focused on requiring exams and dispensing medications. Therefore, it is common to perceive resistance in the population when facing attempts to install health care practices that diverge from what it is already adapted<sup>13</sup>.

One of the reasons why some primary health care units (UBS and USF) do not develop group activities for people with diabetes, for example, is the low adherence due to the population that resists to these new proposals, perhaps due to the low level of education of most of them<sup>14,15</sup>. The reasons found were not only that the general population is more interested in medical consultations, which increases the demand in the units and makes it impossible to develop educational activities, but also because the same population is still unaware of the risks inherent to diseases and the importance of this type of strategy<sup>13,16,17</sup>.

The lack of knowledge of diabetic patients and their caregivers, associated with inadequate training and integration among health professionals, is directly related to the problem of adherence to traditional treatment, impacting the patient's health and quality of life. It is understood that the multiprofessional health team needs to dialogue with patients to make them understand the health-disease process for better adherence to the team's proposals, in addition to the team dialoguing more with each other to perform care based on the principle of integrality proposed by SUS in 1988<sup>10</sup>.

One study involving ten diabetic patients resulted with their majority (seven) replying that their oral health care is the same as that of the general population and the study did not show that they are more likely to get periodontal disease because they are poorly controlled diabetics. In addition, they reported that they didn't

receive any kind of guidance on the relation between oral health and *Diabetes Mellitus*<sup>18</sup>. In a very similar way to the present study, among the 15 patients at the health fair who were classified as hyperglycemic, 40% of them reported not having received any information about this relation and, among those who were educated in some way about *Diabetes Mellitus* during consultations, none reported having received guidance from more than one health professional. Even though these patients have high blood glucose, only 26.6% believe that it can be affected by changes in oral health condition, a low number. However, it was interesting to note that ¾ of those hyperglycemics, who are aware of not only general care but also oral care, know this because they were educated in the consultations they attended recently, showing that patient education is necessary in order for them to understand their health process, disease and also collaborate with the treatment proposals suggested by the teams.

In addition to the concern of oral health influencing glycemic control, it is worth mentioning the bidirectional relation between them, because there are consequences of poor glycemic control on oral health itself<sup>19</sup>. Exemplifying this scenario, studies have reported an association between a lower incidence of caries and compensated diabetes mellitus, which was justified by the metabolic control of diabetes, a low-carbohydrate diet, with an increase in proteins and an increase in the saliva's buffering capacity<sup>20</sup>. Another study, with children between 8 and 16 years old, already diagnosed with Type 1 Diabetes, stated that the majority of patients with glycated hemoglobin levels > 8% were female and developed more dental caries in permanent teeth when compared to patients with hemoglobin glycated <8%, due to the lower flow of saliva, higher glucose concentration, favoring the installation of caries<sup>21</sup>. Comparing these other studies with the current one, although the current study presented the minority of its sample with hyperglycemic adult patients (15 patients - 7.6%), who are predominantly male, the concern with the reflection of this glycemia in oral health is valid because in addition to cavities, there can commonly be periodontal disease (gingivitis and periodontitis), regardless of sex and age of patients. Once periodontal disease is installed, a chronic inflammatory process forms, which worsens insulin resistance, both in type 1 and type 2 diabetes.

Analyzing Graphic 1, it is possible to see that, in the general sample, 73 patients (37.2%) do not receive guidance either from the medical team or from the dental team about the importance of good general health in conjunction with good oral health for better control of capillary glycemia, which shows the integration between incipient doctors and dentists as to the comprehensiveness proposed by SUS for most cases in the sample. However, when comparing patients who receive some kind of guidance on comprehensiveness during health care, in general, it was possible to note that dentists inform their patients more



often about the oral health-general health connection, since 112 (57.1%) were instructed at some point by their dentist, against only 52 (26.5%) by their doctor.

For most of these patients, it is noted that they received multidisciplinary attention, but there was a lack of interdisciplinary attention, that is, an intersection of the different areas of health in the same moment of consultation. According to Graphic 2, when the doctor and the dentist performed this type of care, the patients' glycemic average in absolute numbers was statistically benefited ( $p=0.034$ ), since it was at a lower level (89.21 mg/dl) if compared mainly with the group with guidance compromised by both health teams. The glycemia of the well-oriented group may have had a good result for several reasons, and these cannot be discarded: different professional approaches with the same patient, better dialogue between the health team and the patient, greater understanding and clarification of the health-disease processes and better adherence to indicated treatments.

Although technical dental information has advanced scientifically over the years, effective communication with popular knowledge has not yet been achieved. In a survey with a sample of 40 individuals, 35% of them had bleeding gums as the main sign of periodontitis, a number that appears in the present study in a similar way (35.2%). However, it was argued that patients were only concerned with the situation and sought care when there was a softening of teeth<sup>22</sup>. As much as the dentist orients, often the patient does not assimilate in the way he should and ends up postponing the cure for not recognizing the signs of an oral problem. Neither do they identify that a treatment that would seem to be only dental would benefit health as a whole.

In the present study, when analyzing the group with bleeding gums, it was noted that the minority (21.7%) was educated by the medical and dental team together, but there was no statistical significance when comparing the presence of missing gingival bleeding with education received by health professionals during consultations, since  $RR=1.05$  and  $p < 0.9$ . Still, it is worth mentioning that a majority (52%) who believe they have good or very good oral health, even having reported this pathological gingival condition, showed that for this situation, effective communication with popular knowledge has not yet been achieved.

On the other hand, although only 38.7% believed that oral health is more important for a diabetic patient, as it can improve their capillary blood glucose, most of them (62%) said they had been advised by both teams about the oral health-general health relation, showing that the education provided during the visits impacted their knowledge. In addition, seeing that almost all patients (90.3%) mentioned that they consider the integrated medical and dental care important or even very important, it may already be a sign of change in the fragmented care idea, proposed in the 20th century, as discussed earlier.

The competence of disease prevention and health promotion has some attributions that are well referred to groups of workers, both SUS and non-SUS. They involve participation in team meetings, contribution to the team's action plans and interactions with other sectors in health promotion actions. These attributions, when properly applied, will directly reflect on the effective comprehensiveness discussed thus far<sup>23</sup>. In addition, differentiated professional attitudes, such as attentive listening, humanized reception by the patient, with appropriate responses, willingness to taking responsibility and generating bonds, humanized welcoming and care can also contribute<sup>24</sup>. When it comes to patients in the pediatric age group, there is evidence that the team's approach to schools in the neighborhood can strengthen their bond with the team and bring children and young people to health facilities in an easier way, which would facilitate adherence to intervention, prevention and health promotion measures once they grow<sup>25</sup>.

It is known that the decentralization process of SUS has expanded public dental services with the concern to establish comprehensive and multidisciplinary patient care. However, despite the data showing that dentists guided their patients better in an interdisciplinary way than doctors, the new employment bonds of the dental team in SUS often lead to a high rotation of employees, which may result in compromising the bond and integrality with the patients and other professionals from the health units that work<sup>23,24</sup>.

There are other factors, in addition to the lack of dialogue and interaction between the teams, that can influence the recommended interdisciplinary care, such as the lack of insertion of interdisciplinary content in college education networks for courses in the health area, especially medicine. It has been shown in studies that the medical course deals with few dental contents during graduation, since only 29.7% of pediatric doctors analyzed received instructions on oral health during graduation<sup>26</sup>.

The methods of university education have a primary role in the training of health professionals, since using predominantly vertical methods means neglecting the interaction that should exist between professionals and health patients, which will influence the way that these people will promote health in the future<sup>27</sup>.

As the integration between teaching and working is seen as a potential collaborator in the process of changing practices in health education, the curricular restructuring of health courses, such as inserting interdisciplinary content in the grid, discussing the importance of this for the general health of the patient and inserting students in primary health care units are necessary actions in order for them to understand this process in practice. As the UBSs have been showing a fertile scenario for learning, the attempt of letting the student experience professional work, which is already inserted in the principles of integrality, makes a difference<sup>28</sup>.

Strict collaboration between the patient, the primary health care professionals and oral health care professionals can be an alternative to improve both the general and oral health of the diabetic patient, as individuals with type 2 diabetes in some specific oral conditions had worse overall health<sup>29</sup>.

## CONCLUSION

Providing quality to the oral health of a diabetic person does not cure the disease, but it helps with the glycemic control in some ways, when the diabetic person

has periodontitis or severe oral infection. We emphasize the need, not only for medical students to know the influence of oral health on general health, but also to have public and private health services focused on patient's education, offering comprehensive multiprofessional care to them, since the minority of people knows about the relation that exists between oral health and general health. Thus, it is possible to promote self-care, communication between the different areas of health and better care for the patients, reducing the complications caused by hyperglycemia, which affects the life quality of this relevant portion of the population.

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