International Journal of Innovative Research and Scientific Studies, 8(4) 2025, pages: 2131-2143

IJIRSS
International Journal of Innovative Research & Scientific Studies

ISSN: 2617-6548

URL: www.ijirss.com

Impact of minimed780G insulin pump therapy on quality of life in children and adolescents with type 1 diabetes: A comparative analysis

Ramy S. Abdelghany[1], Mohamed Salah El-Sayed[2,3*], Ghada Mohammad Anwar[4], Mostafa Hassan Mostafa Khedr[5], Radwa Ezzat Amin Mohamed[6]

[1]*Department of Pediatrics, Armed Forces College of Medicine, Egypt.*
[2]*Physiotherapy Department, Faculty of Allied Medical Sciences, Al-Ahliyya Amman University, Jordan.*
[3]*Department of Physical Therapy for Pediatrics, Faculty of Physical Therapy, Horus University-Egypt, New Damietta, Egypt.*
[4,5,6]*Department of Pediatrics, Faculty of Medicine, Cairo University, Egypt.*

Corresponding author: Mohamed Salah El-Sayed (*Email: melsayed@horus.edu.eg*)

Abstract

The prevalence of type 1 diabetes mellitus (T1DM) among children is increasing. Advances in diabetes technology offer improved glycemic control while reducing the risks of hypoglycemia, hyperglycemia, and long-term complications. The MiniMed 780G, an Advanced Hybrid Closed Loop (AHCL) insulin delivery system, represents a significant improvement over traditional multiple daily injection (MDI) therapy. This prospective cohort study assessed the quality of life in 48 pediatric T1DM patients using either the MiniMed 780G or MDI, all monitored at the Endocrinology Outpatient Clinic of Military Hospitals. Participants were divided into two groups: 32 using MDI and 16 using the AHCL system. A structured questionnaire evaluated various aspects of treatment satisfaction. Results indicated that patients on the MiniMed 780G reported significantly higher satisfaction in areas such as diabetes management time, checkup duration, glucose monitoring ease, dietary flexibility, sleep quality, social interactions, academic and household engagement, and leisure activities ($P < 0.05$). Moreover, these patients experienced less pain, improved self-esteem, and reduced anxiety about complications, appearance, and hypoglycemic episodes compared to the MDI group, with all differences being statistically significant.

Keywords: Adolescents, Children, Hybrid closed loop system, Insulin pump MiniMed 780G, Multiple daily injections, Type 1 DM.

DOI: 10.53894/ijirss.v8i4.8351
Funding: This study received no specific financial support.
History: Received: 7 May 2025 / **Revised:** 11 June 2025 / **Accepted:** 13 June 2025 / **Published:** 7 July 2025

Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.
Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
Publisher: Innovative Research Publishing

1. Introduction

Absolute insulin insufficiency causes the chronic autoimmune disease known as type 1 diabetes mellitus (T1DM), which manifests as a disruption of insulin-secreting beta cells within the pancreas. While it often manifests in childhood or adolescence, it can present at any stage of life [1]. Management of T1DM necessitates continuous insulin therapy to maintain glycemic control. The global incidence of T1DM is rising steadily, contributing to substantial personal and healthcare burdens [2].

Across nations, there is a concerted effort to enhance the quality of life for individuals living with T1DM, aiming to minimize disease-related limitations and support a normal lifestyle [3]. Since the FDA's approval of the first Hybrid Closed Loop (HCL) insulin delivery system in 2016, technology in diabetes care has advanced significantly. HCL systems enhance the accuracy of glucose control by combining automated insulin delivery with continuous glucose monitoring (CGM) [4]. Advanced Hybrid Closed Loop (AHCL) systems further refine this approach by including automatic correction boluses as well as basal rate adjustments, aiming to maintain glucose levels within optimal targets [5].

Among these, the MiniMed 780G stands out as one of the most sophisticated AHCL systems currently approved for both pediatric and adult patients with T1DM [6]. Evidence suggests that the MiniMed 780G enhances glycemic outcomes, particularly through improved Time in Range (TIR), when compared to conventional multiple daily injection (MDI) therapy. However, while existing data support its efficacy in adolescents and adults, there is a notable gap in studies focusing on pediatric populations and the system's impact on their quality of life [7].

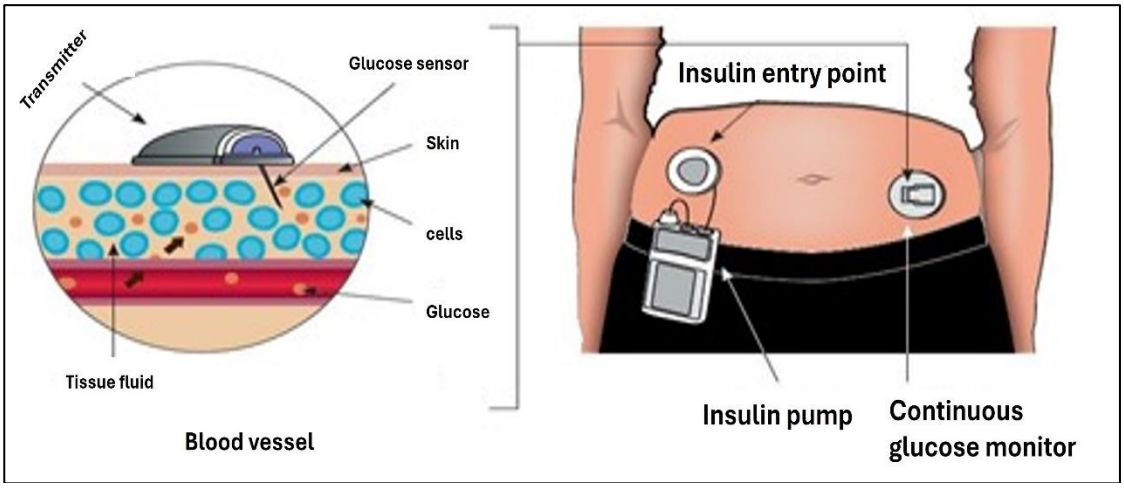

Figure 1.
Schematic illustration of the closed-loop insulin delivery.

2. Materials and Methods

This prospective observational study was done on 48 children and adolescents with their age ranging from 5 to 19 years diagnosed with T1DM and on HCLS of MiniMed 780G or MDI. They were chosen from the endocrinology outpatient clinic of military hospitals in Egypt during a period of 6 months. Children and adolescents diagnosed with T1DM of both genders were diagnosed with DM for at least six months and were either on MiniMed 780G or MDI. All patients were subjected to a Questionnaire (in which an application was designed and sent for all patients to assess their quality of life, and then data was collected electronically and analyzed.

2.1. Exclusion Criteria

- -Patients associated with immunological disorders (e.g., Systemic Lupus).
- -Patients with other systemic diseases (e.g., Liver and Kidney disease, etc.).
- -Patients on other medications that could affect results (e.g., systemic glucocorticoids).

2.2. Sampling

2.2.1. Sample type: Purposive sample

Sample size: Considering a type I error of 0.05 and a type II error of 0.01, with a power of 99% and a confidence level of 95%, the minimum required sample size is 40 patients, equally distributed between groups receiving Multiple Daily Injections or the Hybrid Closed Loop System Insulin Pump MiniMed 780G. The sample size was increased by 20% to account for potential dropouts in prospective studies.

2.3. Ethical Considerations

This study was conducted in accordance with the principles of the Declaration of Helsinki and received approval from the Institutional Review Board at the Armed Forces College of Medicine, Cairo, Egypt (Serial number of the protocol: 167, meeting date: 11/02/2023). The board confirmed that the research protocol did not present any ethical violations, and the principal investigator was responsible for safeguarding the rights and welfare of all human subjects involved.

2.4. Data Collection

All patients were assessed for quality of life by using a questionnaire [8]. Including questions regarding the satisfaction level with treatment, social life, the impact of the disease on life, and patients' concerns.

2.5. Data Analysis

The numerical parametric data were statistically represented using mean ± standard deviation, while non-parametric data were summarized using median and range. Qualitative data were described using frequencies and percentages. When comparing numerical variables among study groups, either the Student's t-test or the Mann-Whitney U test was used. Categorical variables were analyzed with the Chi-square test. Subgroup analyses employed the Wilcoxon Signed-Rank test. Correlations among variables were assessed using the Spearman rank correlation coefficient. Statistical significance was set at p-values less than 0.05. All analyses were performed using SPSS software.

2.6. Statistical Analysis

We used the IBM SPSS software package version 25.0, which was released in 2017 by IBM Corp., to analyze the data fed into the computer. Version 25.0 of IBM SPSS Statistics for Windows (IBM Corp., Armonk, NY). Numerical and percentage descriptions were used for qualitative data. The distribution was checked for normality using the Shapiro-Wilk test. Quantitative data were described using range (minimum and maximum), mean, standard deviation, median, and interquartile range (IQR). The significance of the obtained results was judged at the 5% level. The tests used included the Chi-square test for categorical variables to show associations between two or more categorical (nominal) variables. If more than 20% of the cells have a predicted count lower than 5, Fisher's Exact test or the Monte Carlo correction for chi-square can be used. For quantitative variables with normal distributions, the Student's t-test was used to compare two groups. The Mann-Whitney test was used to compare two groups when the quantitative variables do not follow a normal distribution. When comparing more than two time periods, ANOVA with repeated measures was used for quantitative variables that are normally distributed.

3. Results

3.1. Quality of Life Questionnaire Analysis

3.1.1. Satisfaction

The study findings revealed a marked difference in satisfaction levels between the two groups concerning the time required to manage diabetes. Among the MDI group, 34.4% of participants reported being moderately satisfied, whereas in the MiniMed 780G (G780) group, 75% expressed high satisfaction and 25% were moderately satisfied. The satisfaction score related to diabetes management time was significantly higher in the G780 group compared to the MDI group. According to Table 1 and Figure 2, there is a statistically significant difference among the groups ($P < 0.001$).

Table 1.
Comparison between the two studied groups regarding satisfaction with the time taken to manage Diabetes.

Satisfaction with the time taken to manage Diabetes	MDI group, N=32		G 780 group, N=16		Chi-Square test	
	No.	%	No.	%	Test value	*P* value
Very satisfied	0	0.0	12	75.00	X^2=33.9	<0.001 (HS)
Moderately satisfied	11	34.40	4	25.00		
Neither	16	50.0	0	0.0		
Moderately dissatisfied	4	12.50	0	0.0		
Very dissatisfied	0	0.00	0	0.0		

Note: $P > 0.05$: Not-significant (NS); $P < 0.05$ is statistically significant (S); $P > 0.01$ is highly significant (HS). X^2: Chi-Square test.

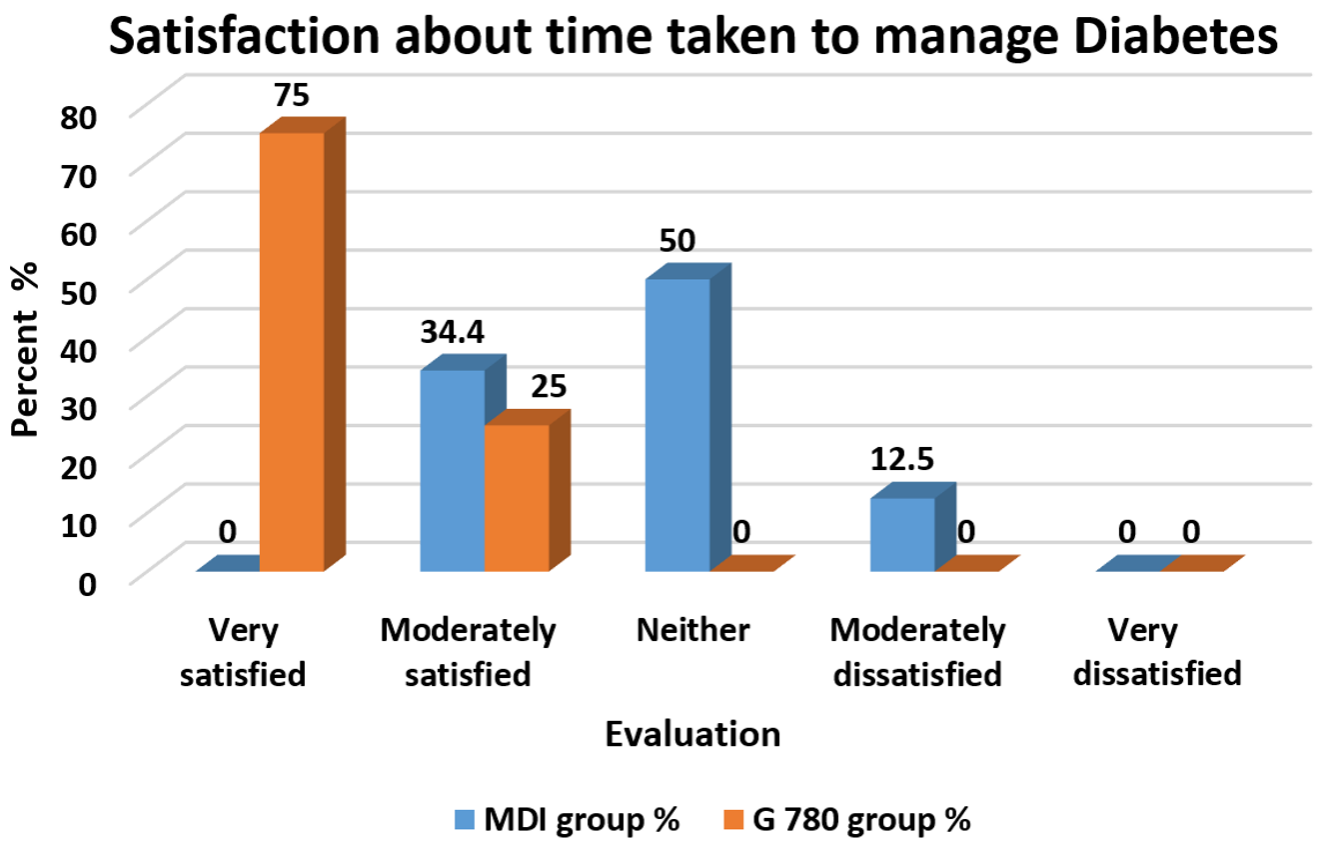

Figure 2.
Comparison between the studied groups regarding Satisfaction, time taken to manage diabetes.

In the MDI group, 37.5% of patients reported moderate satisfaction with the time spent attending checkups. In contrast, within the MiniMed 780G (G780) group, 50% of patients were highly satisfied, and the remaining 50% were moderately satisfied. Statistically significant differences were found between the two groups regarding satisfaction with checkup time, with the G780 group demonstrating significantly higher satisfaction levels compared to the MDI group ($P < 0.001$), as shown in Table 2 and Figure 3.

Table 2.
Comparison between the two studied groups regarding satisfaction with time spent getting checkups.

Satisfaction with the time spent getting checkups	**MDI group (N = 32)**		**G780 group (N= 16)**		**Chi-Square test**	
	No.	**%**	**No.**	**%**	**Test value**	***P* value**
Very satisfied	0	0	8	50	X^2=26.4	<0.001(HS)
Moderately satisfied	12	37.50	8	50		
Neither	19	59.4	0	0		
Moderately dissatisfied	1	3.10	0	0		
Very dissatisfied	0	0	0	0		

Note: P > 0.05: Not-significant (NS), P < 0.05 is statistically significant (S), P < 0.01 is highly significant (HS). X^2: Chi-Square test.

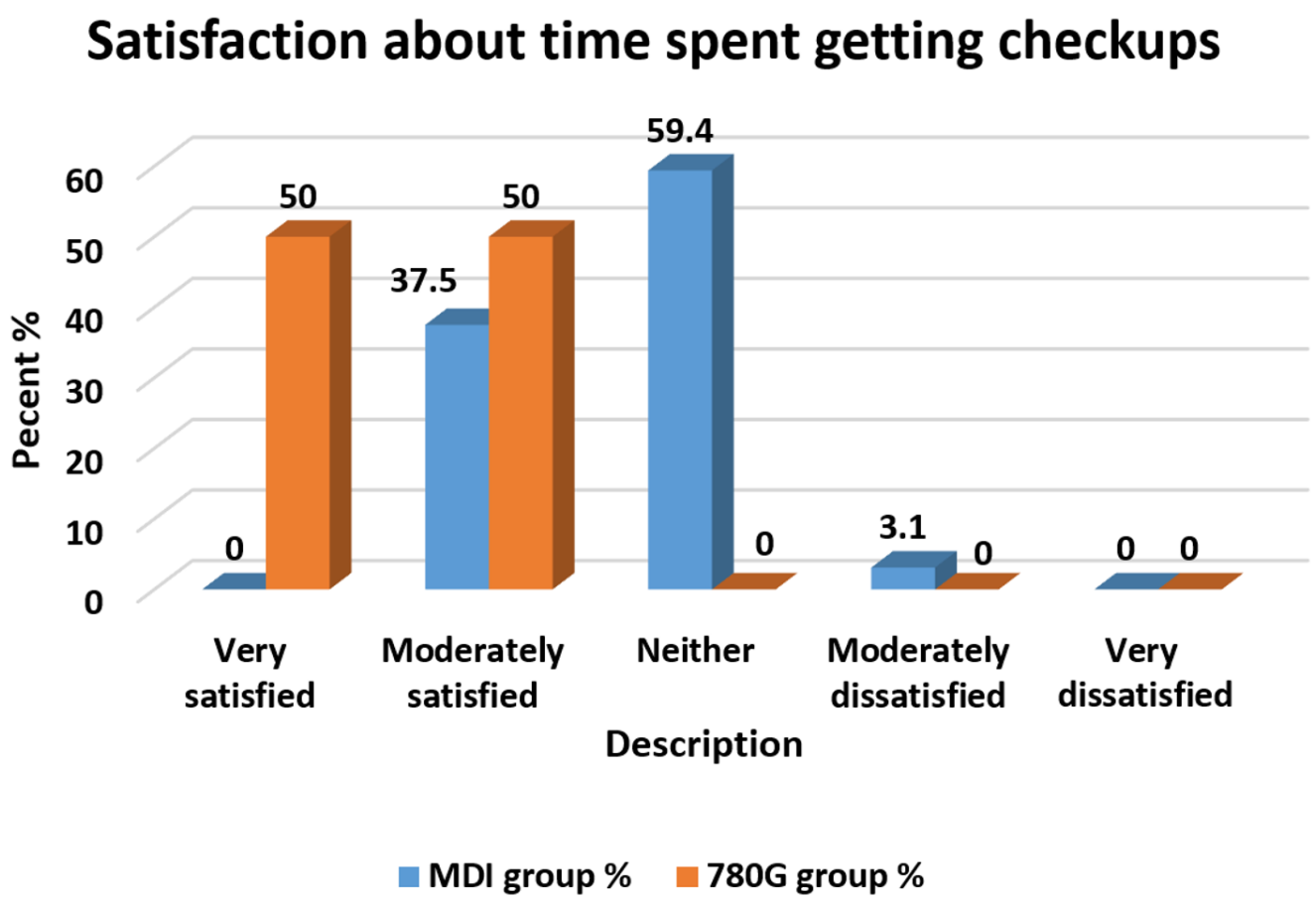

Figure 3.
Comparison between the two studied groups regarding satisfaction with the time spent getting checkups.

In the MDI group, 28.1% of patients reported moderate satisfaction regarding the time required to determine blood glucose levels. Conversely, in the MiniMed 780G (G780) group, 50% of patients were very satisfied, and the remaining 50% were moderately satisfied. There was a statistically significant difference between the two groups regarding satisfaction with the time taken to assess blood glucose levels, with significantly higher satisfaction observed in the G780 group compared to the MDI group (P < 0.001), as shown in Table 3 and Figure 4.

Table 3.
Comparison between the two studied groups regarding satisfaction with the time taken to determine the blood glucose level:

Satisfaction with the time taken to determine the blood glucose level	**MDI group (N=32)**		**G780 group (N= 16)**		**Chi-Square test**	
	No.	**%**	**No.**	**%**	**Test value**	***P* value**
Very satisfied	0	0	8	50	X^2= 28.9	<0.001 (HS)
Moderately satisfied	9	28.10	8	50		
Neither	21	65.50	0	0		
Moderately dissatisfied	2	6.30	0	0		
Very dissatisfied	0	0	0	0		

Note: P >0.05: Not-significant (NS), P <0.05 is statistically significant (S), P < 0.01 is highly significant (HS). X^2:Chi-Square test.

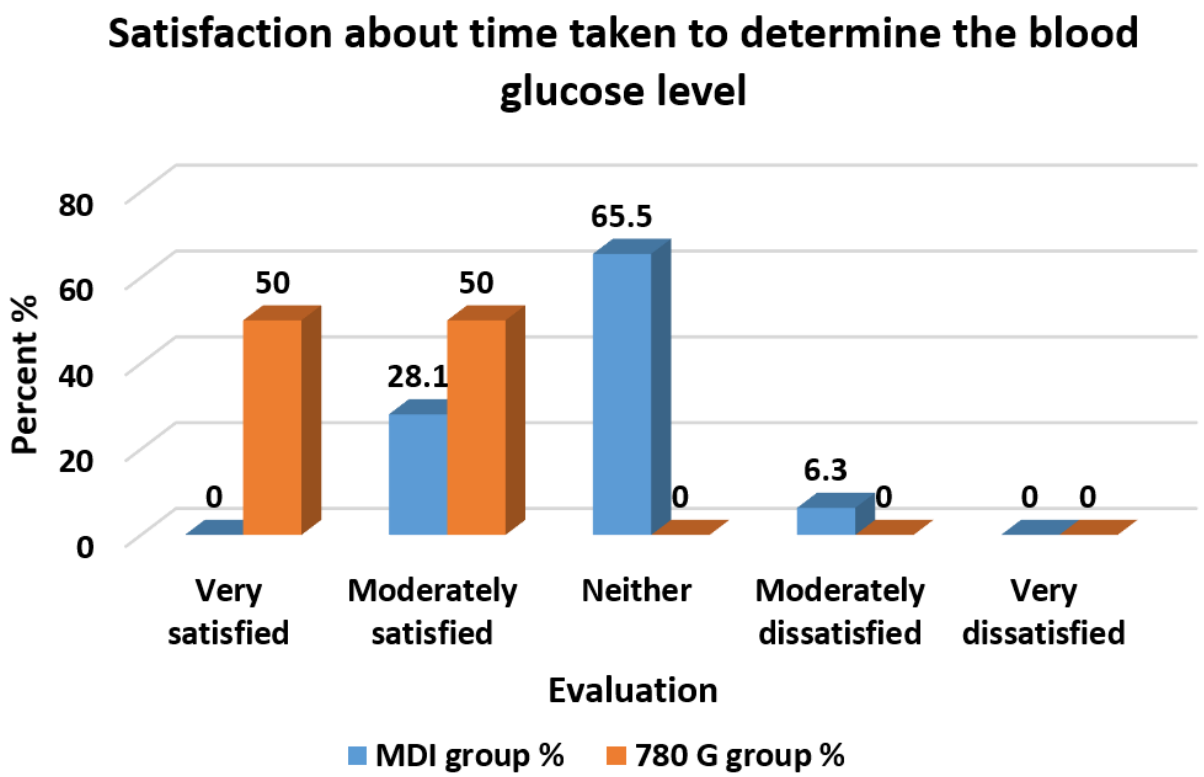

Figure 4.
Comparison between different groups' satisfaction with the time taken to determine the blood sugar level.

In the MDI group, 21.9% of patients were moderately satisfied with their current treatment. In the G780 group, 81.25% of patients were very satisfied, and 18.75% were moderately satisfied. In terms of satisfaction with current treatment, there is a statistically significant difference between the G780 group and the MDI group and the MDI group ($p<0.001$), with the G780 group indicating much higher levels of satisfaction, as shown in Table 4 and Figure 5.

Table 4.
A Comparison between the two studied groups regarding satisfaction with the current treatment.

Satisfaction with current treatment	MDI group (N=32)		G780 group (N= 16)		Chi-Square test	
	No.	%	No.	%	Test value	*P* value
Very satisfied	0	0	13	81.25	X^2= 38.6	<0.001 (HS)
Moderately satisfied	7	21.90	3	18.75		
Neither	16	50.00	0	0		
Moderately dissatisfied	3	9.40	0	0		
Very dissatisfied	6	18.80	0	0		

Note: P >0.05: Not-significant (NS), P <0.05is statistically significant(S), P < 0.01 is highly significant (HS). X^2: Chi-Square test.

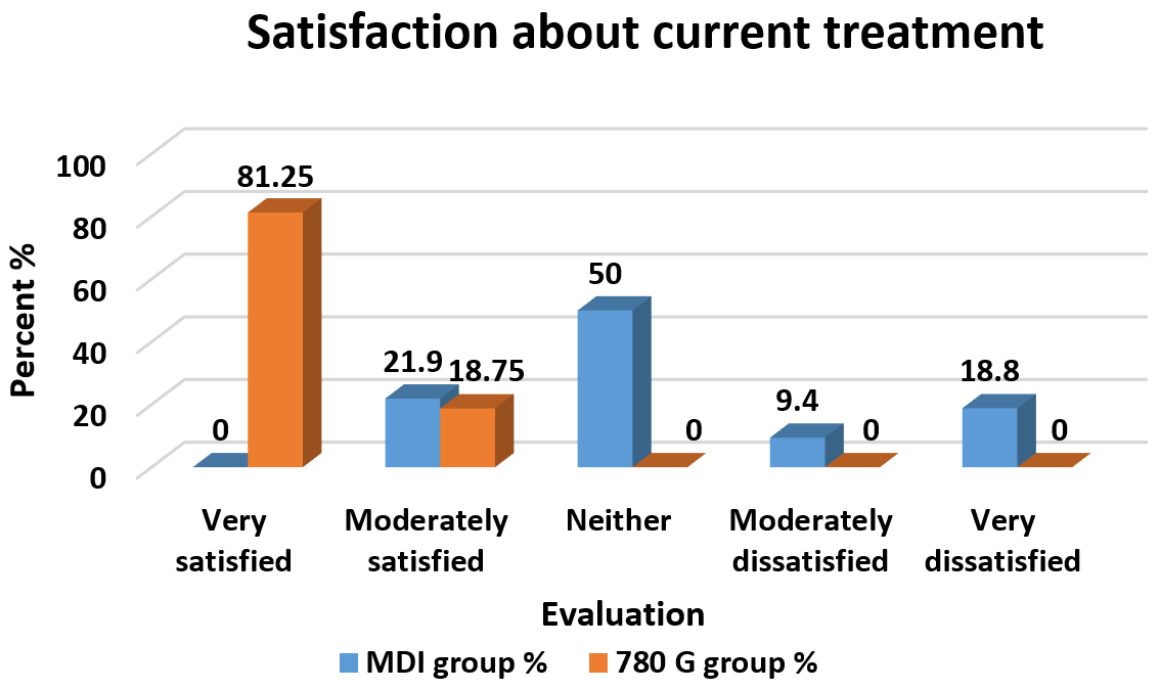

Figure 5.
A comparison between the studied groups regarding satisfaction with the current treatment.

In the MDI group, 75% of patients were moderately satisfied with the flexibility of their diet. In the G780 group, 18.75% of patients were very satisfied, and 81.25% were moderately satisfied. A statistically significant difference was observed between the two groups regarding satisfaction with diet flexibility (*P*=0.007), as it was significantly greater in the G780 group in comparison with the MDI group, as shown in Table 5 and Figure 6.

Table 5.
A Comparison between the two studied groups regarding satisfaction with the flexibility they have in their diet.

Satisfaction with the flexibility they have in their diet	MDI group (N=32)		G780 group (N= 16)		Chi-Square test	
	No.	%	No.	%	Test value	*P* value
Very satisfied	0	0	3	18.75	X^2= 10.05	<0.007 (HS)
Moderately satisfied	24	75	13	81.25		
Neither	8	25	0	0		
Moderately dissatisfied	0	0	0	0		
Very dissatisfied	0	0	0	0		

Note: P >0.05: Not-significant (NS), P <0.05is statistically significant (S), P <0.01is highly significant (HS). X^2:Chi-Square test.

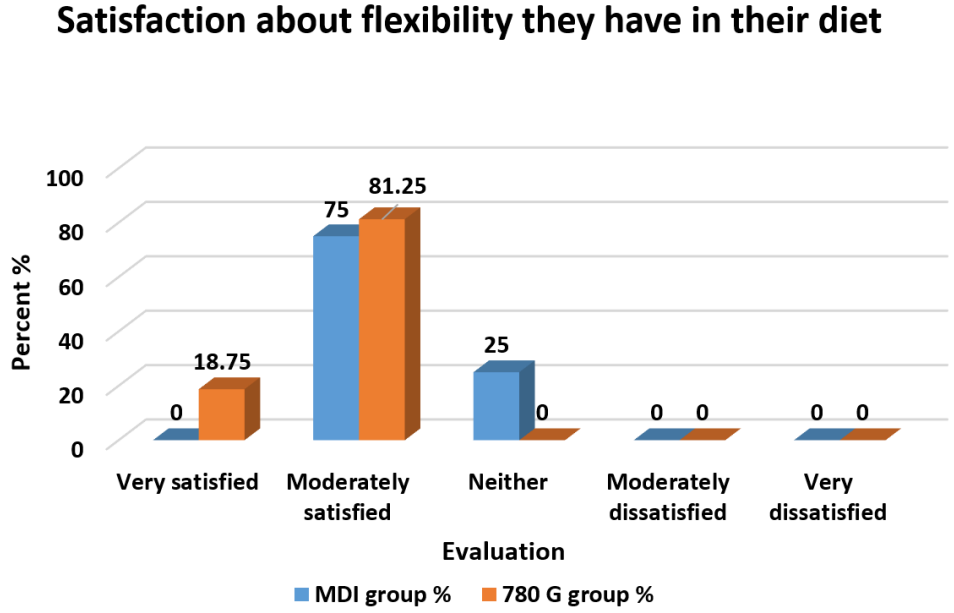

Figure 6.
A comparison between the studied groups regarding satisfaction with the flexibility they have in their diet.

In the MDI group, 3.1% of patients were very satisfied with their sleep, while 78.1% were moderately satisfied. In the G780 group, 31.25% of patients were very satisfied, and 68.75% were moderately satisfied. A statistically significant difference was observed between the two groups regarding satisfaction with sleep (*P*=0.007) because it was significantly greater in the G780 group than in the MDI group, as shown in Table 6 and Figure 7.

Table 6.
Comparison between the two studied groups regarding satisfaction with sleep.

Satisfaction with sleep	MDI group (N=32)		G780 group (N= 16)		Chi-Square test	
	No.	%	No.	%	Test value	*P* value
Very satisfied	1	3.10	5	31.25	X^2= 9.88	0.007 (HS)
Moderately satisfied	25	78.10	11	68.75		
Neither	6	18.80	0	0		
Moderately dissatisfied	0	0	0	0		
Very dissatisfied	0	0.00	0	0		

Note: P >0.05: Not-significant (NS), P <0.05 is statistically significant (S), P <0.01is highly significant (HS). X^2:Chi-Square test.

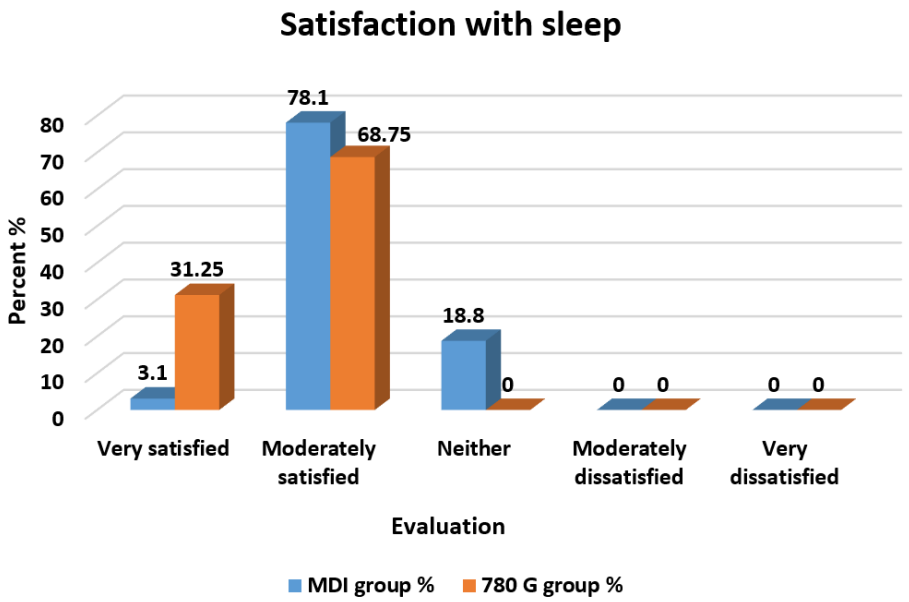

Figure 7.
Comparison between the two studied groups regarding satisfaction with sleep.

In the MDI group, 3.1% of patients were very satisfied with social relationships; 68.8% were moderately satisfied. In the G780 group, 12.5% of patients were very satisfied, and 87.5% were moderately satisfied. A statistically significant difference was observed between the two groups regarding satisfaction with social relationships (*P*=0.039) because it was significantly greater in the G780 group in comparison with the MDI group, as shown in Table 7and Figure 8.

In the MDI group, 6.25% of patients were very satisfied with school and household activities, and 62.5% were moderately satisfied. In the G780 group, 6.25% of patients were very satisfied, and 93.75% were moderately satisfied. A statistically significant difference was observed between the two groups regarding satisfaction with social relationships (*P*=0.04), with the G780 group showing significantly higher satisfaction compared to the MDI group, as shown in Table 7 and Figure 8.

Table 7.
Comparison between the two studied groups regarding satisfaction with school and household activities.

Satisfaction with school and household activities	MDI group (N=32)		G780 group (N= 16)		Chi-Square test	
	No.	%	No.	%	Test value	*P* value
Very satisfied	2	6.25	1	6.25	X^2= 6.43	0.040 (S)
Moderately satisfied	20	62.50	15	93.75		
Neither	10	31.25	0	0		
Moderately dissatisfied	0	0	0	0		
Very dissatisfied	0	0	0	0		

Note: P > 0.05: Not-significant (NS), P <0.05 is statistically significant (S), P <0.01 is highly significant (HS). X^2:Chi-Square test.

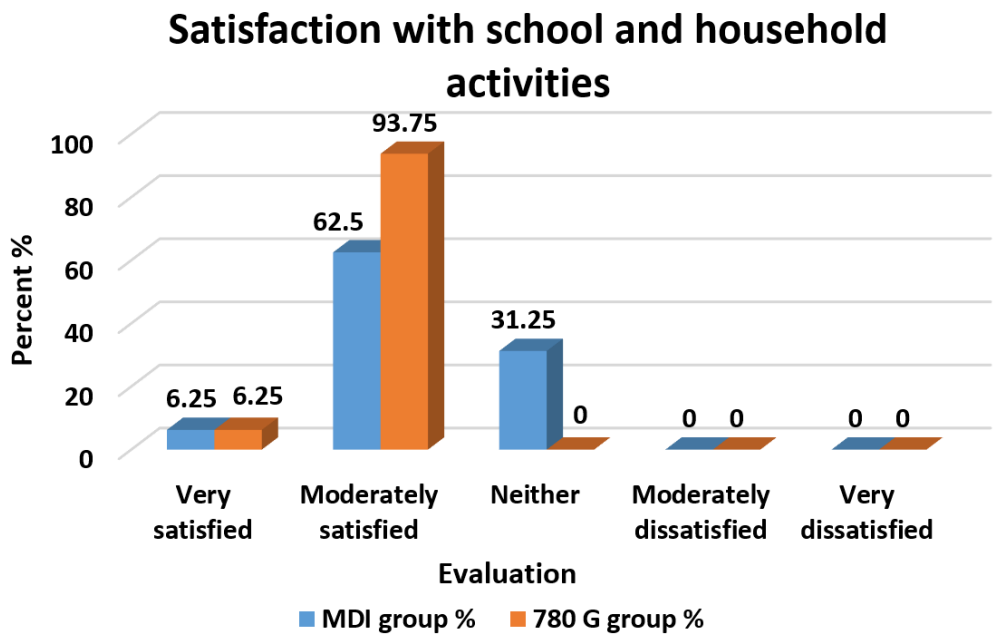

Figure 8.
Comparison between two study groups regarding satisfaction with work, school, and household activities.

In the MDI group, 6.3% of patients were moderately satisfied with the time spent exercising. While in the G780 group, 25% of patients were moderately satisfied. No statistically significant difference was observed between the two groups regarding satisfaction with time spent exercising (P>0.05), as shown in Table 8 and Figure 9.

Table 8.
Comparison between the two studied groups regarding satisfaction with the time spent exercising.

Satisfaction with the time spent exercising	MDI group (N=32)		G780 group (N= 16)		Chi-Square test	
	No.	%	No.	%	Test value	*P* value
Very satisfied	0	0	0	0	X^2= 5.51	0.063 (NS)
Moderately satisfied	2	6.30	4	25		
Neither	25	78.10	12	75		
Moderately dissatisfied	5	15.60	0	0		
Very dissatisfied	0	0	0	0		

Note: P > 0.05: Not-significant (NS), P <0.05is statistically significant (S), P <0.01 is highly significant (HS). X^2:Chi-Square test.

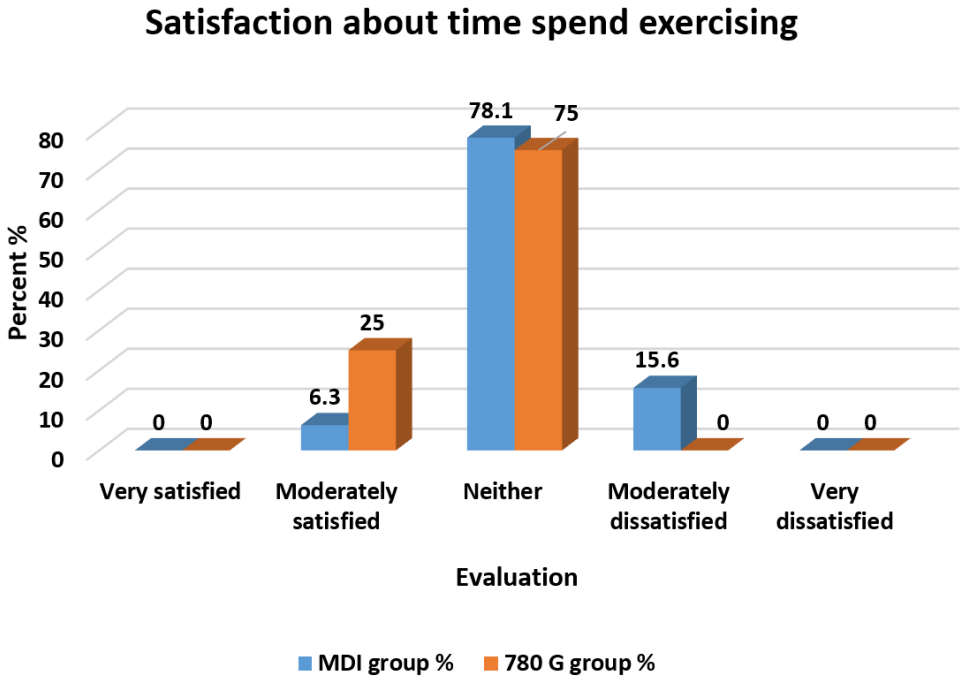

Figure 9.
Comparison between the two study groups regarding satisfaction with time spent exercising.

In the MDI group, 18.8% of patients experience pain due to DM treatment very rarely, 59.4% sometimes, 15.6% often, and 6.3% feel pain all the time. In the G780 group, none of the patients experienced pain due to DM treatment. A statistically significant difference was observed between the two groups regarding pain caused by DM treatment ($P < 0.001$), with the G780 group experiencing significantly less pain compared to the MDI group, as shown in Table 9 and Figure 10.

Table 9.
Comparison between the two studied groups regarding the feeling of pain due to DM treatment.

Feeling pain due to DM treatment	MDI group (N=32)		G780 group (N= 16)		Chi-Square test	
	No.	%	No.	%	Test value	*P* value
Never	0	0	16	100	X^2= 48.0	0.001 (HS)
Very seldom	6	18.80	0	0		
Sometimes	19	59.40	0	0		
Often	5	15.60	0	0		
All the time	2	6.30	0	0		

Note: P > 0.05: Not-significant (NS), P <0.05is statistically significant (S), P <0.01 is highly significant (HS). X^2: Chi-Square test.

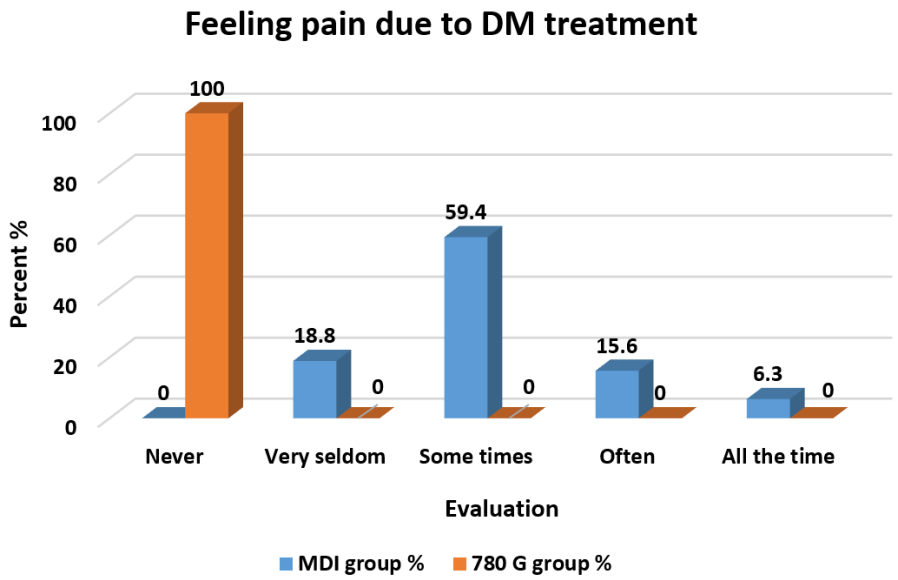

Figure 10.
Comparison between the two study groups regarding feeling pain due to DM treatment.

3.2. Worry

A statistically significant difference was observed among the two groups concerning worry about passing out, body looks different, and getting complications ($P<0.05$), being higher in the MDI group, as shown in Table 10**.**

Table 10.
Comparison between the two studied groups regarding the worry domain.

How often do you worry about		MDI group (N=32)		G780 group (N= 16)		Chi-Square test	
		No.	%	No.	%	Test value	*P* value
Able to take a vacation or a trip	Never	32	100.0%	16	100.0%	-	-
	Very seldom	0	0.0%	0	0.0%		
	Sometimes	0	0.0%	0	0.0%		
	Often	0	0.0%	0	0.0%		
	All the time	0	0.0%	0	0.0%		
Passing out	Never	1	3.1%	6	37.5%	X^2= 18.6	<0.001 (HS)
	Very seldom	10	31.3%	9	56.25%		
	Sometimes	14	43.8%	1	6.25%		
	Often	7	21.9%	0	0.0%		
	All the time	0	0.0%	0	0.0%		
The body looks different	Never	13	40.6%	0	0.0%	X^2= 8.97	0.011 (S)
	Very seldom	16	50.0%	13	81.25%		
	Sometimes	3	9.4%	3	18.75%		
	Often	0	0.0%	0	0.0%		
	All the times	0	0.0%	0	0.0%		
Get complications	Never	0	0.0%	2	12.5%	X^2= 8.39	0.039 (S)
	Very seldom	7	21.9%	5	31.25%		
	Sometimes	17	53.1%	9	56.25%		
	Often	8	25.0%	0	0.0%		
	All the time	0	0.0%	0	0.0%		

Note: P > 0.05: Not-significant (NS), P <0.05is statistically significant (S), P <0.01 is highly significant (HS). X^2:Chi-Square test.

4. Discussion

Diabetes mellitus (DM) is a significant non-communicable disease that is becoming increasingly prevalent in both developed and developing nations. It encompasses a range of metabolic disorders characterized by hyperglycemia, which results from abnormalities in insulin secretion or action. In Egypt, DM has become a critical public health concern and is recognized as a modern global pandemic. It ranks among the top ten causes of death worldwide. There are mainly two etiological groups that account for the majority of diabetes cases: two types of diabetes, type 1 (T1DM) and type 2 (DM2). Type 1 DM is a chronic condition characterized by an inability to secrete insulin and requires effective metabolic management, particularly in pediatric patients, to prevent or delay the onset of associated complications [9].

According to Miller et al. [10], a significant proportion of individuals with T1DM, across all age groups, do not meet their glycemic targets, highlighting the need for new approaches and therapies for optimal metabolic management. The considerable challenge of diabetes management arises from the necessity of frequent insulin dose adjustments, which influence insulin sensitivity and glucose levels, and are required to prevent hypoglycemia in T1DM [11]. This leads to daily fluctuations in insulin requirements and glucose levels. To mitigate both hypoglycemia and hyperglycemia, HCL devices employ advanced control algorithms that automatically adjust basal insulin delivery according to glucose sensor readings [12, 13].

Recent advancements in technology, specifically the introduction of the Advanced AHCL system, have revolutionized the management and treatment of T1DM. Studies have demonstrated that these systems can decrease the probability of hypoglycemia and blood glucose variations. Medtronic's MiniMedTM 670G and MiniMedTM 780G (SmartGuardTM) and Insulet's Omnipod Automated Mode (HypoProtectTM) are two of the three main AHCL systems on the market today, while Tandem's T slim X2 with Control IQ is the third. All AHCL systems are designed to work with an overall daily insulin dosage (TDDI) of 8 to 10 units, with restrictions on lower doses. The MiniMedTM 780G Advanced Hybrid Closed-Loop system, an upgraded version of the SmartGuardTM technology, was introduced in 2020. In the fall of 2020, it became available on the European market after receiving Conformité Européenne (CE) certification in June of that year.

One of the latest advancements in HCL systems is the MiniMed 780G (Medtronic, Northridge, CA, USA), which became available in select countries in October 2020. This system provides automated bolus correction when necessary, as well as automatic basal insulin delivery with a customizable glucose target [14]. To our knowledge, no previous studies have been conducted in Egypt to explore the potential impact of AHCL systems in children with T1DM. Therefore, this prospective cohort study was undertaken with 48 children and adolescents with T1DM, who were using either the MiniMed 780G Hybrid Closed Loop System (HCLS) or Multiple Daily Injections (MDI) therapy. These patients were admitted to the Endocrinology Outpatient Clinic at the Military Hospitals. The study subjects were divided into two groups: 32 patients utilizing MDI and 16 patients utilizing the MiniMed 780G Hybrid Closed Loop System insulin pump.

To eliminate the contribution of any confounding factors that may affect the final outcome, the current study enrolled two well-matched groups at baseline. No statistically significant differences were observed among the studied groups in terms of age, clinical history, complaints, allergies, and DM duration.

Glycemic control is primarily influenced by patient self-management, and the success of this self-management is closely tied to the psychosocial factors of the individual, including their satisfaction with the quality of diabetes care received. Patients who are satisfied with their care are more likely to establish stronger, longer-lasting relationships with their healthcare providers, which leads to improved adherence to treatment, continuity of care, and ultimately, better clinical outcomes. Regarding the quality-of-life questionnaire administered to the study groups, the overall satisfaction was found to be slightly higher in the G780 group compared to the MDI group; however, the difference was not statistically significant (P=0.057).

The findings revealed that the satisfaction scores for various aspects, including the time spent managing diabetes, time spent on checkups, time taken to measure blood glucose levels, satisfaction with the current treatment, flexibility in managing their diet, knowledge about diabetes, sleep quality, social relationships, school and household activities, and leisure time, were all significantly greater in the G780 group compared to the MDI group. These findings suggest that the G780 system offers enhanced satisfaction across multiple dimensions of diabetes management and overall well-being.

However, there was no statistically significant difference between the two groups concerning satisfaction with the burden diabetes places on their family, satisfaction with body appearance, and satisfaction with the time spent exercising (P>0.05). Regarding the impact, the current study demonstrated that the G780 group reported feeling better compared to the MDI group, particularly in terms of experiencing less discomfort from diabetes therapy, fewer episodes of low blood sugar, improved physical well-being, and greater self-confidence.

No statistically significant difference was detected between the two groups regarding feelings of shame when managing diabetes in public places, the need to explain what it means to have diabetes, how they communicate about their condition to others, being teased for not being able to eat sweets due to diabetes, or the tendency to eat something inappropriate instead of disclosing their condition (P>0.05). However, in the worry domain, the current study revealed a statistically significant difference between the two groups concerning concerns about passing out, fainting, and changes in the appearance of their bodies (P<0.05).

For children and adolescents with type 1 diabetes, the current study indicates that the MiniMed 780G system is significantly more effective than MDI in terms of health-related quality of life, impact, concern domains, and satisfaction. In the early 1980s, the Diabetes Quality of Life Measure (DQOL) was used in the Diabetes Control and Complications Trial (DCCT), a randomized clinical trial, to assess the effects of various treatment protocols on the development and progression of long-term complications in insulin-dependent diabetes mellitus (IDDM). The DQOL was developed to evaluate the relative difficulty of managing diabetes daily with an intensive treatment program aimed at maintaining blood glucose levels as close to those of individuals without diabetes as possible.

According to Matejko et al. [15] the mean overall Diabetes Quality of Life (DQOL) score in the Multiple Daily Injections (MDI) group increased from 187 ± 32 to 202 ± 54; however, no change was observed in the AHCL group, where the score remained unchanged from baseline (173 ± 46) to three months (173 ± 53). After adjusting for baseline values, no significant difference was observed among the two groups (P = 0.287). Similarly, Cyranka et al. [16] found that transitioning from MDI self-monitoring of blood glucose treatment to AHCL in just three months led to significant improvements in psychological well-being and overall quality of life in patients who were new to the technology.

In general, the level of life satisfaction among individuals in the study was similar to that of the overall population. Results from a study by Wheeler et al. [17] suggest that the AHCL system may help adults and adolescents with type 1 diabetes feel more satisfied with their treatment and experience better subjective sleep quality when compared to Sensor-Augmented Pump therapy with Predictive Low Glucose Management (SAP+PLGM) mode. Furthermore, Petrovski et al. [14] demonstrated that the average Diabetes Treatment Satisfaction Questionnaire (DTSQ) score for users of the MiniMed 780G system increased significantly from 3.6 ± 0.6 pre-treatment to 4.6 ± 0.8 by the end of the trial (P = 0.001). Similarly, the average DTSQ score for parents improved from 3.5 ± 0.6 at baseline to 4.8 ± 0.9 at the end of the trial, indicating comparable outcomes (P = 0.001).

5. Conclusion

This study provides strong evidence supporting the MiniMed 780G system as an effective method for improving health-related quality of life in children and adolescents with Type 1 Diabetes Mellitus, ultimately enhancing disease management and patient outcomes.

References

[1] E. Y. Almomani, H. Y. Almomani, S. Al-Azzam, A. Qablan, and A. Al-Momany, "The rising burden of chronic kidney diseases in patients with diabetes," Beni-Suef University Journal of Basic and Applied Sciences, vol. 12, no. 1, p. 88, 2023. https://doi.org/10.1186/s43088-023-00428-y

[2] H. M. Abd El-lateef *et al.*, "Therapeutic effect of N, N-Diphenyl-1, 4-phenylenediamine and adipose-derived stem cells coadministration on diabetic cardiomyopathy in type 1 diabetes mellitus-rat model," Journal of Experimental Zoology Part A: Ecological and Integrative Physiology, vol. 341, no. 6, pp. 647-657, 2024. https://doi.org/10.1002/jez.2810

[3] C. C. Patterson *et al.*, "Worldwide estimates of incidence, prevalence and mortality of type 1 diabetes in children and adolescents: Results from the International Diabetes Federation Diabetes Atlas," Diabetes Research and Clinical Practice, vol. 157, 2019.

[4] R. M. Bergenstal *et al.*, "A comparison of two hybrid closed-loop systems in adolescents and young adults with type 1 diabetes (FLAIR): A multicentre, randomised, crossover trial," The Lancet, vol. 397, no. 10270, pp. 208-219, 2021.

[5] C. K. Boughton and R. Hovorka, "New closed-loop insulin systems," Diabetologia, vol. 64, pp. 1007-1015, 2021.

[6] M. de Bock, J. Dart, M. Hancock, G. Smith, E. A. Davis, and T. W. Jones, "Performance of Medtronic hybrid closed-loop iterations: Results from a randomized trial in adolescents with type 1 diabetes," Diabetes Technology & Therapeutics, vol. 20, no. 10, pp. 693-697, 2018.

[7] P. I. Beato-Víbora, F. Gallego-Gamero, A. Ambrojo-López, E. Gil-Poch, I. Martín-Romo, and F. J. Arroyo-Díez, "Rapid improvement in time in range after the implementation of an advanced hybrid closed-loop system in adolescents and adults with type 1 diabetes," Diabetes Technology & Therapeutics, vol. 23, no. 9, pp. 609-615, 2021.

[8] W. Al-Qerem, B. Al-Maayah, and J. Ling, "Developing and validating the Arabic version of the Diabetes Quality of Life questionnaire," Eastern Mediterranean health journal= La revue de sante de la Mediterranee orientale= al-Majallah al-sihhiyah li-sharq al-mutawassit, vol. 27, no. 4, pp. 414-426, 2021.

[9] I. Bebu *et al.*, "Risk factors for first and subsequent CVD events in type 1 diabetes: the DCCT/EDIC study," Diabetes Care, vol. 43, no. 4, pp. 867-874, 2020.

[10] K. M. Miller *et al.*, "Current state of type 1 diabetes treatment in the US: updated data from the T1D Exchange clinic registry," Diabetes care, vol. 38, no. 6, pp. 971-978, 2015.

[11] Y. Ruan *et al.*, "Variability of insulin requirements over 12 weeks of closed-loop insulin delivery in adults with type 1 diabetes," Diabetes Care, vol. 39, no. 5, pp. 830-832, 2016.

[12] A. Weisman, J.-W. Bai, M. Cardinez, C. K. Kramer, and B. A. Perkins, "Effect of artificial pancreas systems on glycaemic control in patients with type 1 diabetes: a systematic review and meta-analysis of outpatient randomised controlled trials," The Lancet Diabetes & Endocrinology, vol. 5, no. 7, pp. 501-512, 2017.

[13] T. Biester, O. Kordonouri, and T. Danne, "Beyond type 2 diabetes: sodium glucose co-transporter-inhibition in type 1 diabetes," Diabetes, Obesity and Metabolism, vol. 21, pp. 53-61, 2019.

[14] G. Petrovski *et al.*, "Glycemic outcomes of advanced hybrid closed loop system in children and adolescents with type 1 diabetes, previously treated with multiple daily injections (MiniMed 780G system in T1D individuals, previously treated with MDI)," BMC Endocrine Disorders, vol. 22, no. 1, p. 80, 2022.

[15] B. Matejko *et al.*, "Transitioning of people with type 1 diabetes from multiple daily injections and self-monitoring of blood glucose directly to MiniMed 780G advanced hybrid closed-loop system: a two-center, randomized, controlled study," Diabetes Care, vol. 45, no. 11, pp. 2628-2635, 2022.

[16] K. Cyranka *et al.*, "Improvement of selected psychological parameters and quality of life of patients with type 1 diabetes mellitus undergoing transition from multiple daily injections and self-monitoring of blood glucose directly to the MiniMed 780G advanced hybrid closed-loop system: Post hoc analysis of a randomized control study," JMIR Formative Research, vol. 7, p. e43535, 2023.

[17] B. J. Wheeler *et al.*, "Improved technology satisfaction and sleep quality with Medtronic MiniMed® Advanced Hybrid Closed-Loop delivery compared to predictive low glucose suspend in people with Type 1 Diabetes in a randomized crossover trial," Acta Diabetologica, vol. 59, no. 1, pp. 31-37, 2022.