Brief Report: Disordered Eating and Psychosocial Factors in Adolescent Females with Type 1 Diabetes Mellitus

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Objective To evaluate whether insulin pump therapy [continuous subcutaneous insulin infusion (CSII)] is associated with a lower frequency of disordered eating, better glycemic control, and improved quality of life and self-efficacy compared to multiple daily injections (MDI) in adolescent females with type 1 diabetes mellitus (T1DM). **Methods** This cross-sectional study included 22 adolescent females using CSII and 47 adolescent females using MDI who completed standardized questionnaires measuring disordered eating, quality of life, and self-efficacy. Most recent glycosylated hemoglobin ($HbA1_c$) and measures of personal characteristics were drawn from medical records. **Results** The CSII group exhibited better glycemic control and reported higher quality of life and more self-efficacy. However, the groups did not differ significantly on disordered eating behaviors and attitudes. **Conclusion** Insulin pump therapy may provide a means for improving glycemic control, quality of life, and self-efficacy in adolescent females with type 1 diabetes.

Key words diabetes; disordered eating; insulin pump; glycemic control; quality of life.

Females with type 1 diabetes mellitus (T1DM) may be especially vulnerable to developing disordered eating due to several factors related to the onset and management of their disease (Daneman, Olmsted, Rydall, Maharaj, & Rodin, 1998). That is, significant weight loss immediately before the diagnosis of diabetes followed by rapidly regaining of weight with the initiation of insulin treatment may amplify concerns over weight and body shape in vulnerable young females. Dietary restraint along with an emphasis on exercise for improved diabetes management may further exacerbate body dissatisfaction and encourage a drive for thinness. These problems may promote inappropriate compensatory behaviors such as insulin omission to suppress weight gain. Insulin omission involves reducing or withholding the necessary amount of insulin the body requires and is one of the most common weight loss strategies observed in females with T1DM (Peveler et al., 2005). Disordered eating in females with T1DM can severely impair metabolic control (Jones, Lawson, Daneman, Olmsted, & Rodin, 2000) and advance the onset of long-term complications (Rydall, Rodin, Olmsted, Devenyi, & Daneman, 1997).

To delay the onset and slow the progression of various complications associated with T1DM, the American Diabetes Association recommends intensive insulin therapy (Diabetes Control and Complications Trial Research Group, 1994). Intensive insulin therapy utilizes either multiple daily injections (MDI) or insulin pump [continuous subcutaneous insulin infusion (CSII)]. MDI involves the daily administration of three or more insulin injections containing a mixture of intermediate and long acting insulin. Such treatment may result in the accumulation of unabsorbed insulin and hypoglycemia. To correct for hypoglycemia individuals need to consume additional calories. The alternative to MDI is CSII, which uses a catheter subcutaneously

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inserted into the abdomen or one of the extremities (i.e., legs or arms) and connects to a pump device via tubing that contains fast acting insulin (Reynolds, 2000). Thus, CSII enables individuals to decrease their total daily insulin dose up to 15% (Bode, Steed, & Davidson, 1996), resulting in less circulatory insulin and fewer occurrence of hypoglycemia. CSII reduces the need to consume extra calories, thereby improving weight control.

In addition to the physiological benefits, CSII can improve lifestyle flexibility by lowering glycemic risks associated with delaying meals, sleeping late, or engaging in vigorous exercise. In fact, adolescents using CSII cope better with diabetes and report fewer overall difficulties than those using MDI (Boland, Grey, Oesterle, Fredrickson, & Tamborlane, 1999). Allowing adolescents to perceive more control through their treatment modality may strengthen self-efficacy in coping with diabetes. Moreover, self-efficacy or self-expectations of competence, control, and creativity for successfully managing diabetes can improve adherence in those who accept the responsibility for managing their chronic disease. Increased self-efficacy in adolescent females with diabetes was associated with better metabolic control (Grossman, Brink, & Hauser, 1987).

In summary, individuals using CSII may enjoy a more flexible lifestyle that could reduce the risk for developing disordered eating, achieve better glycemic control, and enhance their psychosocial functioning. It was hypothesized that adolescent females using CSII will report a lower frequency of disordered eating and exhibit better glycemic control compared with those using MDI. In addition, adolescent females using CSII are expected to express better quality of life and higher self-efficacy for diabetes (SED).

Methods

Participants

Participants were recruited from an endocrinology clinic in a Midwest children's hospital. Eligible participants were adolescent females, 12–18 years old, diagnosed with T1DM for at least 18 months who had been using either CSII or MDI for 6 months or longer. Exclusion criteria were previous rejection of CSII use, diagnosis of any other medical problems and/or illnesses (e.g., celiac disease), or visual and/or auditory impairments that may interfere with diabetic treatment or participation in the study. Of the 72 adolescent females with T1DM who were invited to participate, 69 (96%) were included in the analyses. Three adolescent females were not included because of short disease duration (8 months), carried another major illness (celiac disease), or failed to return the completed packet. Twenty-two participants were using CSII and 47 participants were using MDI.

Measures

Personal characteristics were collected from participants' medical charts, including date of birth, date of diagnosis, height, and weight. Body mass index (BMI) was calculated using height and weight measurements (Sizer & Whitney, 2000). Glycemic control was based on the most recent serum glycosylated hemoglobin ($HbA1_c$).

Based on previous studies of disordered eating, we used the following measures: the Drive for Thinness, the Bulimia, and the Body Dissatisfaction subscales of the Eating Disorder Inventory-2 (EDI-2; Garner, 1991), and the Dietary Restraint subscale of the Eating Attitudes Test-26 (EAT-26; Garner, Olmsted, Bohr, & Garfinkel, 1982). Two additional questions ("I skip insulin shots to lose weight" and "I take less insulin than I am supposed to, to lose weight") were included to address insulin omission (Meltzer et al., 2001). Diabetes Quality of Life (DQOL; Ingersoll & Marrero, 1991) and SED (Grossman et al., 1987) were used to measure the psychosocial variables.

EDI-2

The EDI-2 (Garner, 1991) is a 64-item multidimensional self-report inventory divided into 8 subscales that assesses symptoms of anorexia and bulimia. Only three of these subscales were administered: Drive for Thinness, Bulimia, and Body Dissatisfaction. These scales have adequate reliability and validity (Garner, Olmsted, & Polivy, 1983). Each subscale provides six response choices ranging from Never to Always. The Drive for Thinness subscale contains questions measuring preoccupation with weight and dieting. The Bulimia subscale contains questions measuring binging and purging behaviors. The Body Dissatisfaction subscale contains questions measuring satisfaction with specific body parts such as waist, thighs, and buttock. The item that could relate to dietary restrictions associated with T1DM management that did not reflect eating pathology was excluded (e.g., "I eat sweets and carbohydrates without feeling nervous"). Higher scores indicate more disordered eating.

EAT-26

The EAT-26 (Garner et al., 1982) contains 26 questions that measure attitudes, feelings, and behaviors characteristic of individuals with disordered eating and has three subscales: Dietary Restraint, Bulimia, and Oral control. The EAT-26 has high internal consistency ($\alpha = .90$). It provides 6 response choices ranging from Never to

Always. The Dietary Restraint subscale relates to avoiding fattening foods and a preoccupation with being thinner. Higher scores indicate more disordered eating.

DQOL

The DQOL (Ingersoll & Marrero, 1991) contains three subscales: Satisfaction, Impact, and Worry. The Satisfaction subscale includes questions assessing the individual's level of satisfaction with their diabetes. Response choices vary across five categories from Very Satisfied to Very Dissatisfied. The Impact subscale includes questions inquiring how much of an impact does diabetes have on the individual's life. Five response choices vary from Never to All the Time. The Worry subscale includes questions inquiring on how often does one worry about their diabetes. In addition to Does Not Apply, five response choices vary from Never to All the time.

Each DQOL subscale score was transformed by dividing the difference between the actual summed score and the lowest possible score, and then multiplying by 100 to produce a percentage of positive quality of life (Jacobson, de Groot, & Samson, 1994). Higher scores on each of these subscales indicate better quality of life. The total DQOL was calculated by taking the average of the three subscale scores. Because the three subscales assessing DQOL are highly correlated with each other, (Satisfaction and Worry, $r = .59$; Satisfaction and Impact, $r = .67$; Worry and Impact, $r = .82$), only the total DQOL was used in the analyses.

SED

The SED (Grossman et al., 1987), a 35 items questionnaire, examines how much an individual believes he/she can or cannot do what is being asked. SED response choices were based on a 6-point Likert scale ranging from being "very sure I can't" to being "very sure I can". Higher scores reflect greater self-efficaciousness.

Procedure

Eligible participants were approached during their routine clinic appointment for recruitment. Participants who were 17-years-old and younger gave written assent and their parents/guardians gave written consent, whereas participants who were 18-years-old gave written consent to participate in the study. A packet of self-report questionnaires was distributed, requiring 20 min for completion. Each participant received a $5.00 gift certificate after participation.

Analyses

The analyses were conducted using SPSS 11.5 version computer program (SPSS, Chicago, IL). Means and standard deviations were calculated for all continuous variables. The assumptions of normality, linearity, and homogeneity of variance were assessed, and adjusted t values were used when homogeneity of variance was violated. Zero-order correlations were performed using Pearson product-moment correlations (r). Group differences were evaluated using independent t tests for continuous variables and chi-square (χ^2) for categorical variables. Multivariate analysis of variance (MANOVA) was used to examine disordered eating, and a one-way analysis of variance (ANOVA) was used to examine glycemic control. An alpha level of .05 was used for all statistical analyses.

Results

Demographics

Ninety-six percent of the CSII group and 92% of the MDI group were Caucasian. The treatment groups did not differ in relation to racial backgrounds, $\chi^2(1, N = 69) = 1.73$, $p = .42$. Means and standard deviations for age, height, weight, BMI, and disease duration are presented in Table I. The treatment groups were similar in age, height, weight, BMI, and disease duration.

Disordered Eating and Glycemic Control

Disordered eating and glycemic values for treatment groups are presented in Table II. The Drive for Thinness, Bulimia, and Body Dissatisfaction subscales of the EDI-2, and the Dietary Restraint subscale of the EAT-26 scores were analyzed in the MANOVA. The treatment groups were similar across these four disordered eating scores as evidenced by a nonsignificant MANOVA, using Wilks' Lambda, $F(4, 64) = 1.30$, $p = .28$. Insulin omission could not be included in this between group analyses because none of the participants in the CSII group and only 7 participants (15%) in the MDI group reported reducing or skipping their insulin dose.

Table I. Personal Characteristics in the Continuous Subcutaneous Insulin Infusion (CSII) ($n = 22$) and Multiple Daily Injections (MDI) ($n = 47$) Groups

	CSII		MDI	
	M	*SD*	*M*	*SD*
Age (years)	14.09	1.85	14.49	1.74
Height	64.79	4.26	63.25	2.49
Weight	140.43	29.44	133.69	23.58
BMI	23.41	3.31	23.47	3.41
Disease duration (years)	6.82	3.37	7.48	3.66

BMI, body mass index; calculated BMI, [(weight in pounds/height in inches^2) × 705].

All ps > .30, except for height $p = .07$.

Table II. Disordered Eating, Glycemic Control, and Psychosocial Measures in the Continuous Subcutaneous Insulin Infusion (CSII) ($n = 22$) and Multiple Daily Injections (MDI) ($n = 47$) Groups

	CSII		MDI	
	M	*SD*	*M*	*SD*
EDI-2				
Drive for thinness	1.77	3.65	3.83	4.85
Bulimia	0.23	0.53	1.17	1.96
Body dissatisfaction	5.55	5.81	7.02	5.77
EAT-26				
Dietary restraint	3.14	3.45	4.13	4.45
$HbA1_c$ (%)*	7.84	1.29	9.11	1.81
DQOL total*	77.89	9.65	69.37	14.67
SED*	178.05	16.71	163.54	24.21

DQOL, Diabetes Quality of Life—higher scores indicate better quality of life; EAT-26, Eating Attitudes Test-26—higher scores indicate more dietary restraint; EDI-2, Eating Disorder Inventory-2—higher scores indicate higher drive for thinness, more bulimic tendencies, and higher body dissatisfaction; $HbA1_c$, glycosylated hemoglobin A1c—higher levels indicate poorer glycemic control; SED, self-efficacy for diabetes—higher scores indicate more self-efficacy.
*$p < .05$

Finally, the CSII group exhibited lower $HbA1_c$ levels ($M = 7.84\% \pm 1.29$) than the MDI group ($M = 9.10\% \pm 1.80$), $F(1, 67) = 8.64$, $p < .01$, $d = .77$.

Psychosocial Variables

As displayed in Table II, the CSII group reported higher total DQOL scores ($M = 77.89 \pm 9.65$), than the MDI group ($M = 69.37 \pm 14.67$), $t(67) = 2.48$, $p = .02$, $d = .70$. Similarly, the CSII group reported higher SED scores, ($M = 178.05 \pm 16.71$), than the MDI group ($M = 163.54 \pm 24.21$), $t(67) = 2.54$, $p = .01$, $d = .71$.

Insulin Omission

Because insulin omission was excluded from the planned analyses, exploratory analyses were conducted. Within the MDI group, those participants omitting insulin exhibited worse glycemic control ($HbA1_c = 10.33 \pm 1.88$) than those not omitting ($HbA1_c = 8.89 \pm 1.72$), $t(45) = 2.02$, $p = .05$, $d = .80$. They were also older (age = $16.14 \pm .90$) than those not omitting (age = 14.20 ± 1.70), $t(45) = 2.94$, $p < .01$, $d = 1.50$. Those omitting insulin did not differ significantly on BMI, $t(45) = .65$, $p = .52$, or disease duration, $t(45) = .75$, $p = .46$, with those not omitting.

Discussion

The primary purpose of this study was to compare the relationship of two intensive insulin treatments with disordered eating in adolescent females with T1DM. Because of the presumed greater lifestyle flexibility, it was hypothesized that adolescent females using CSII would report a lower frequency of disordered eating than those using MDI. However, no significant differences emerged between CSII and MDI groups regarding disordered eating.

As predicted, the CSII group showed improved glycemic control compared with the MDI group. That is, the CSII group exhibited lower $HbA1_c$ levels than the MDI group, thus replicating previous findings from experimental studies involving adolescent and adult samples (Boland et al., 1999; Hanaire-Broutin, Melki, Bessieres-Lacombe, & Taubert, 2000).

In support our hypothesis, the CSII group reported higher quality of life and more self-efficacy related to diabetes than those in the MDI group. These results corroborate a recent finding of improvements in self-reported general health and mental health-related quality of life in patients using CSII compared with those using MDI over 4 months of treatment (DeVries, Snoek, Kostense, Masurel, & Heine, 2002). Although another study reported improvements 5 years after initiating CSII, in the absence of a control group those effects are difficult to interpret (Kaufman et al., 1999). Further, the long-term effects of enhanced quality of life and self-efficacy with CSII appear less predictable based on nonsignificant findings over 12 months (Boland et al., 1999).

We also examined insulin misuse. While none of the participants in the CSII group reported taking less insulin and/or skipping insulin injections, 15% of the participants in the MDI group reported engaging in such behaviors. This latter subgroup had significantly higher levels of $HbA1_c$, presumably related to the insulin omission. Insulin omission can have serious consequences such as more frequent hospitalizations, increased episodes of diabetic ketoacidosis, and negative psychological symptoms (Daneman et al., 1998). Thus, future investigations should examine the possibility that females with T1DM using MDI may be at an increased risk for omitting insulin.

There are several limitations to this study including the cross-sectional design that limits analyses to correlations between treatment groups, disordered eating, and psychosocial variables. The nonsignificant relationship between treatment groups and disordered eating could be a result of the small sample size. Based on this study, a power analysis revealed a total of 120 participants would be required to detect a significance difference on disordered eating scores. In addition, the data provided relied mostly on adolescent self-report without cross-informant data, thus subject to bias. Although CSII was shown to be associated with better glycemic control and improved

psychosocial functioning, differences between treatment groups remain potentially confounded by self-selection of treatment type. Future research needs to reexamine disordered eating in females with T1DM with respect to CSII and MDI by randomly assigning individuals to treatment groups and prospectively investigating these issues.

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