Effect of Adjunctive Pramlintide Treatment on Treatment Satisfaction in Patients With Type 1 Diabetes

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OBJECTIVE — To assess the effect of adjunctive pramlintide treatment on treatment satisfaction in patients with type 1 diabetes treated with intensive insulin regimens.

RESEARCH DESIGN AND METHODS — Intensively treated (multiple daily injection [MDI] or continuous subcutaneous insulin infusion [CSII] pump therapy) patients with type 1 diabetes completed a study-specific treatment satisfaction questionnaire following 29 weeks of either placebo ($n = 136$) or pramlintide ($n = 130$) treatment in a double-blind, noninferiority pramlintide dose titration trial. End points included patient reported outcomes, their relationship to insulin treatment regimen, A1C, weight, and insulin use.

RESULTS — Pramlintide-treated patients reported greater treatment satisfaction in most questionnaire responses. Treatment satisfaction was similar for pramlintide-treated patients regardless of intensive insulin regimens (MDI versus CSII). Mean A1C was reduced to a similar degree in both pramlintide- ($-0.39 \pm 0.07\%$) and placebo-treated ($-0.45 \pm 0.07\%$) patients. However, pramlintide treatment was associated with reductions in mean body weight (-1.50 ± 0.33 kg; $P < 0.0001$) and mealtime insulin use ($-19.05 \pm 5.17\%$; $P < 0.005$) over 29 weeks, while placebo treatment resulted in weight gain (1.28 ± 0.25 kg) and a smaller reduction in mealtime insulin use ($-2.20 \pm 3.33\%$).

CONCLUSIONS — Despite similar reductions in A1C, pramlintide treatment resulted in greater treatment satisfaction compared with placebo treatment. This was independent of insulin delivery method.

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Recent epidemiological data report that ~35% of patients with type 1 diabetes are in poor glycemic control (1). Examining the daily experience of the insulin-treated patient highlights the motivational challenges of intensive therapy. Beyond avoiding future complications, there are few discernable incentives to intensify insulin. However, there are clearly tangible disincentives, including increased risk for severe hypoglycemia and weight gain (2–6). Additionally, clinical trials using continuous glucose monitoring devices recently have documented that the typical 24-h blood glucose profile of patients achieving near normoglycemia is characterized by profound, and often rapid and frequent, fluctuations (7–9). For example, Boland et al. (7), in a study of patients using intensive insulin regimes, demonstrated a clear disassociation between diurnal blood glucose control and A1C level. Almost 80% of recorded postmeal blood glucose values in subjects with A1C levels of ≤7.5% were in the moderate-to-severe hyperglycemic range, whereas the majority of nocturnal values were in the hypoglycemic range.

Considering these issues, it is understandable that patient adherence may gradually diminish with long-term intensive therapy. A recent study (10) reported that most patients with type 1 and 2 diabetes experienced symptoms of depression, anxiety, and burnout that interfered with diabetes self-management. Thus, a therapy providing tangible improvement in day-to-day diabetes control might represent a valuable clinical tool for insulin-using patients, particularly for motivated patients failing to achieve optimal glycemic control with intensive insulin therapy.

The discovery of amylin has led to the development of a medication that has been shown to improve glycemic control in insulin-using patients with diabetes (11). Amylin is a hormone that is colocated and cosecreted with insulin from pancreatic β-cells (11). Like insulin, amylin is absent in patients with type 1 diabetes and deficient in patients with late-stage type 2 diabetes (12). Animal models have demonstrated that amylin regulates gastric emptying, postprandial glucagon secretion, and food intake (11). These effects complement insulin's effect on glucose disposal by limiting the appearance of glucose in the circulation following meals. Pramlintide, a synthetic amylin analog indicated as an adjunctive treatment to insulin in patients with type 1 and 2 diabetes, acutely reduces postprandial glucose fluctuations and enhances satiety (13–15). Long-term, adjunctive pramlintide therapy decreases A1C with concomitant reductions in insulin use and body weight in patients with type 1 and type 2 diabetes (16,17).

The primary aim of this end-of-study survey was to evaluate, under double-blind conditions, the effects of premeal subcutaneous pramlintide versus placebo injections on aspects of treatment satisfac-

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Abbreviations: CSII, continuous subcutaneous insulin infusion; MDI, multiple daily injections.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

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Table 1—*Baseline characteristics*

Demographics	Placebo	Pramlintide	*P* value*
n	136	130	
Sex (%) (male/female)	40/60	49/51	0.096
Age (years)	41 ± 12	41 ± 14	0.218
Weight (kg)	80.6 ± 17.0	81.8 ± 17.4	0.479
BMI (kg/m^2)	27.7 ± 4.7	27.7 ± 4.7	0.866
A1C (%)	8.1 ± 0.8	8.1 ± 0.7	0.959
Duration of diabetes (years)	21 ± 12	20 ± 12	0.465
Race (%)			
Non-Hispanic white	92	94	0.946
Hispanic	5	3	0.878
African American	2	2	
Asian American	1	1	
Average daily insulin dose (units)			
Mealtime	27.8 ± 16.1	26.1 ± 14.3	0.318
Basal	27.3 ± 16.2	29.6 ± 19.8	0.651
Total	55.1 ± 27.3	55.7 ± 28.8	0.801
Insulin regimen			
MDI (three or more injections)	68 (50)	55 (42)	
CSII	68 (50)	75 (58)	0.141

Data are means ± SD and *n* (%) unless otherwise indicated. *P value of between-group analysis (pramlintide versus placebo).

tion including perceived improvement in blood glucose predictability, appetite, and weight control. Additional survey items assessed if perceived benefits represented a significant improvement over insulin alone and if they outweighed the burden of extra injections.

RESEARCH DESIGN AND METHODS

Survey analysis

Survey data were analyzed on a post hoc basis for 266 of 296 intensively treated (multiple daily injection [MDI] or continuous subcutaneous insulin infusion [CSII] pump therapy) patients with type 1 diabetes who completed a 29-week, double-blind, noninferiority pramlintide dose-titration trial. The 30 subjects who did not complete the questionnaire (12% of the experimental group and 8% of the control subjects) were lost to follow-up in the study. Details of the parent study design are reported in full elsewhere (18). In brief, patients were randomized to receive either placebo or pramlintide injections before meals (30/60 μg) in addition to their insulin. The study began with a 4-week initiation period followed by a 25-week maintenance period. During initiation, it was recommended that mealtime insulin be reduced 30–50%, reflecting the decreased demand for mealtime insulin with pramlintide treatment. While this recommended insulin dose reduction applied to placebo-treated patients, insulin dosing was always adjusted according to clinical judgement. Pramlintide was introduced at a dose of 15 μg and titrated in 15-μg increments as tolerated (nausea) to a final dose of 30 or 60 μg at the end of the 4-week initiation period. For placebo-treated patients, injection volumes increased to the same volume equivalent as the pramlintide-treated patients to maintain blinding.

Patients remained on a stable dose of pramlintide for the 25-week maintenance period of the study, with insulin doses adjusted to optimize glycemic control. Throughout the study all patients, pramlintide, as well as placebo treated, optimized insulin usage using the same criteria. During initiation, patients reduced or increased basal insulin if preprandial glucose concentrations were <130 or >180 mg/dl, respectively. Patients also reduced or increased mealtime insulin if postprandial glucose concentrations were <160 or >240 mg/dl, respectively. During the maintenance period, patients reduced or increased basal insulin if preprandial glucose concentrations were <110 or >140 mg/dl, respectively. Patients also reduced or increased mealtime insulin if postprandial glucose concentrations were <140 or >180 mg/dl, respectively. Subjects were asked to perform glucose measurements before and after every meal for the entire 29-week study period as part of the study protocol.

Patients

Inclusion criteria included ≥18 years of age, insulin use for ≥1 year, an A1C between 7.5 and 9.0%, stable body weight (±2.5 kg within 2–6 months before screening), and no symptoms of severe hypoglycemia for 6 months before screening. Female subjects were postmenopausal, surgically sterile, or using adequate contraception. Approximately 50% of patients used MDI (three or more injections per day), and 50% used CSII in conjunction with self-monitored blood glucose testing (prepost each major meal and at bedtime). There were slightly more subjects using CSII assigned to the experimental group, but the difference was not statistically significant ($P = 0.14$). Patients were excluded if they had clinically significant comorbid conditions or used oral antidiabetes agents, bile acid–sequestering agents, antiobesity agents, or medications affecting gastrointestinal motility. Baseline characteristics were well matched between treatment groups with similar insulin delivery methods (Table 1).

Treatment satisfaction survey measurements

To address treatment satisfaction, a 14-item questionnaire was created specifically for this trial. The majority of items are consistent with those found on previously validated instruments, including the Diabetes Treatment Satisfaction Questionnaire and the Treatment Satisfaction component of the Diabetes-Specific Quality of Life Scale (19,20). Additional items were added to evaluate whether the unique aspects of pramlintide therapy impacted treatment satisfaction. For example, "7) Study medication provided benefits that insulin alone has not provided me; 10) Study medication provided me with enough benefit to outweigh the extra injections." Each item was coded on a six-point Likert scale, with one representing strongly disagree and six representing strongly agree. All patients completed the 14-item treatment satisfaction questionnaire at the conclusion of their exposure to either pramlintide or placebo at 29 weeks.

Statistical analyses

Efficacy end point data for the subjects who completed the patient satisfaction survey ($n = 266$) were summarized de-

Table 2—*Change from baseline A1C, weight, and insulin use in patients who answered the treatment satisfaction questionnaire*

End point	Placebo	Pramlintide	*P* value*
n	136	130	
A1C (%)	−0.45 ± 0.07	−0.39 ± 0.07	NS
Weight (kg)	1.28 ± 0.25	−1.50 ± 0.33	<0.0001
Average daily insulin dose (%)			
Mealtime	−2.20 ± 3.33	−19.05 ± 5.17	<0.0005
Basal	18.88 ± 6.80	13.18 ± 6.07	NS
Total	4.44 ± 3.39	1.24 ± 8.57	<0.005
Mean postprandial glucose (mg/dl)	172.7 ± 2.1	151.3 ± 2.2	<0.01

Data are means ± SD unless otherwise indicated. **P* value of between-group analysis (pramlintide versus placebo). NS, not significant.

scriptively. Parametric between-treatment analyses of change in A1C, weight, and insulin use from baseline to week 29 were performed using a general linear model at a significance level of 0.05. The model covariates included treatment (pramlintide or placebo), study site, and baseline A1C.

Differences between treatment groups on individual survey items were analyzed with separate two-way (2 × 2) ANOVA. Grouping factors were treatment (placebo versus pramlintide) and insulin delivery mode (MDI versus CSII). A main effect for treatment was the primary outcome of interest. This component of the ANOVA tested whether the mean survey ratings differed significantly across the groups. The interaction term of the 2 × 2 ANOVA evaluated whether the comparison between placebo and pramlintide for each survey differed as a function of insulin delivery mode (i.e., MDI versus CSII). A secondary descriptive analysis also was performed to further elucidate group differences on survey ratings: the percent of patients within each treatment group responding with either a five or six (i.e., agree or strongly agree) was calculated for each survey item.

RESULTS

Primary efficacy and safety end points

Reductions in A1C following 29 weeks of pramlintide treatment were similar for the pramlintide- and placebo-treated patients who answered the treatment satisfaction questionnaire (Table 2). Placebo-treated patients used significantly more mealtime insulin and more insulin overall. This reflects protocol instructions to increase basal insulin if fasting plasma glucose >140 mg/dl and to increase mealtime insulin if postprandial glucose >180 mg/dl. At week 29, the average percent change from baseline for basal insulin was +19.0 and +13% for placebo- versus pramlintide-treated patients, respectively; at week 29, the average percent change from baseline for mealtime insulin was −2.0 and −19% for placebo- versus pramlintide-treated patients, respectively. Thus, placebo-treated patients required considerably more insulin to achieve equivalent overall glycemic control (per A1C). In addition, pramlintide-treated patients had significantly lower postprandial glucose excursions while having equivalent overall glycemic control as placebo-treated patients, as measured by mean postprandial glucose concentrations (Table 2). Finally, placebo-treated patients gained weight, whereas pramlintide-treated patients lost weight over the course of the 29-week trial. (Table 2).

The most common adverse events observed were reduced appetite, vomiting, sinusitis, nausea, and severe hypoglycemia (reporting criteria: ≥10% and at least twofold-greater incidence in any pramlintide-treated group [30/60 μg] than in the placebo-treated group). These adverse events were similar to those in the original study, with the exception of an increased incidence of somnolence and asthenia in the 30-μg pramlintide-treated group of the treatment satisfaction cohort. Adverse events observed ≥10% and with at least twofold-greater incidence in any pramlintide-treated group (30 or 60 μg) than in the placebo-treated group (i.e., reduced appetite, vomiting, sinusitis, nausea, severe hypoglycemia) were similar to those observed in the population as a whole (18), with the exception of an increased incidence of somnolence and asthenia in the 30-μg pramlintide-treated group of the treatment satisfaction cohort.

Survey outcomes

Mean survey ratings for the pramlintide- compared with placebo-treated patients were highly significant (reflecting stronger agreement) on the following items: "study medication made my blood glucose control more even or predictable," "provided me with more flexibility in what I can eat," "made it easier to control my weight," and "made it easier to control my appetite. " The magnitude of these differences is highlighted by the substantially higher percentage of pramlintide-treated patients with ratings of agree/strongly agree (Table 3) on each of these items.

Substantially more pramlintide-treated patients agreed or strongly agreed that study medication provided benefits that insulin alone had not and that these benefits outweighed the burden of extra injections. Most patients, regardless of treatment assignment, indicated that study medication did not make it easier to avoid hypoglycemia but that side effects, including hypoglycemia, would not prevent them from using it on a long-term basis (Table 3). Nearly twice as many pramlintide- than placebo-treated patients agreed or strongly agreed that study medication reduced worries about having diabetes, increased confidence about managing diabetes, improved how they felt overall, and improved functioning at home, work, or school (Table 3).

In analyses adjusting for possible differences in age, sex, duration of diabetes, quality of glycemic control (as measured by A1C), and BMI, neither sex nor duration of diabetes was significantly related to any of the 14 questions, while patient age, quality of glycemic control, and BMI did show limited interaction with treatment. However, each of these interactions was modest and related only to question 13, "I would like to continue taking the study medication."

Influence of insulin delivery method

Placebo-treated patients on CSII reacted more negatively to the patient satisfaction questionnaire compared with their placebo-treated counterparts on MDI (Table 4). However, patient satisfaction scores for pramlintide-treated patients were not different when categorized by mode of insulin delivery (CSII versus MDI).

Patients were given the opportunity to use pramlintide in an open-label extension following completion of the 29-week blinded trial. Of 266 patients that completed the survey during the double-blind

Table 3—*Patient-reported outcomes*

Question	Placebo (n = 136)	Pramlintide (n = 130)	P value*
1) Made my blood sugar control more even or predictable	3.15 (25)	4.16 (47)	<0.001
2) Provided me with more flexibility in what I can eat	2.91 (20)	3.40 (26)	<0.01
3) Made it easier to control my weight	2.35 (9)	3.68 (35)	<0.001
4) Made it easier to avoid low blood sugar reactions (hypoglycemia)	2.77 (15)	2.82 (12)	NS
5) Made it easier to control my appetite	2.67 (15)	3.98 (47)	<0.001
6) Had some side effects that would keep me from using it on a long-term basis	1.74 (5)	2.26 (15)	<0.005
7) Provided benefits that insulin alone has not provided me	2.76 (20)	4.24 (56)	<0.001
8) Reduced at least some of my worries about having diabetes	2.63 (13)	3.19 (25)	<0.005
9) Made me feel more confident about managing my diabetes	3.23 (29)	3.99 (45)	<0.001
10) Provided me with enough benefit to outweigh the extra injections	2.94 (25)	4.12 (50)	<0.001
11) Improved my ability to function at home, at work, or at school	2.61 (13)	3.23 (24)	<0.001
12) Improved how I feel overall	2.91 (21)	3.83 (44)	<0.001
13) I would like to continue taking the study medication	4.20 (60)	4.65 (66)	NS
14) I would recommend the study medication to other people with diabetes	4.25 (54)	4.86 (72)	<0.005

Data are means (% agree). **P* value denotes significance between mean score for placebo versus pramlintide. NS, not significant.

phase, 205 (108 of 136 placebo-treated subjects and 97 of 130 pramlintide-treated subjects) elected to continue in the open-label extension. These patients repeated the survey upon completing 6 months of open-label pramlintide treatment. These data (Table 5) show that pramlintide-treated patients responded similarly on the survey administered at week 29 and after 6 months of the open-label phase. The responses of placebo-treated patients electing to use pramlintide in the open-label phase improved relative to their week 29 assessment and were similar to the responses of patients originally randomized to pramlintide.

CONCLUSIONS — The results of this retrospective analysis indicate that adjunctive pramlintide therapy improved perceived control over important aspects of diabetes management, including blood glucose predictability, appetite, and weight control, in a group of patients with type 1 diabetes receiving intensive insulin therapy. These outcomes are consistent with the pharmacodynamic profile of pramlintide, including attenuated diurnal and postprandial glycemic excursions, enhanced satiety, and reduced food intake (13–15). Improvements in daily symptom control may account for positive responses by pramlintide-treated patients who reported increased confidence in their ability to manage their diabetes and function at home, work, or school and an increased overall sense of well being.

Patients' positive perceptions of pramlintide therapy did not appear to be affected by age, sex, duration of diabetes, initial quality of glycemic control, or mode of insulin delivery, suggesting a genuine drug effect. Moreover, the benefits of pramlintide therapy appeared to outweigh the potential burden of extra injections associated with using the drug. This was particularly evident for patients using CSII, a population that might be expected to be more troubled by extra injections but who, nonetheless, had satisfaction scores comparable with those administering insulin through MDIs. One might expect that insulin pump users would have less glucose variation between basal and postmeal states and, thus, be less influenced by the positive effects of pramlintide. However, pump users who took pramlintide during the blinded portion of the trial reported significantly greater satisfaction than those pump users treated with placebo.

In previous studies in which pramlintide was initiated at a fixed dose and mealtime insulin was not proactively reduced, there was an increased incidence of insulin-induced severe hypoglycemia in pramlintide-treated patients. In this study, pramlintide dose escalation with concomitant insulin dose reduction during initiation lowered rates of severe hypoglycemia in pramlintide-treated patients to levels similar to placebo-treated patients using insulin (18). Consistent with this, patients receiving pramlintide or placebo treatment reported similar experiences with respect to study treatment's effect on their ability to avoid hypoglycemia. While pramlintide has been associated with transient nausea, this effect appeared to be mitigated by the dose titration schedule utilized in the present study (18). In response to the questionnaire, patients using pramlintide reported more side effects associated with the drug, but these differences did not negatively impact patients' desire to continue using pramlintide or their willingness to recommend it to others.

The study data did not directly assess why patients using pramlintide consistently reported improved satisfaction with their diabetes treatment. One possibility is that pramlintide's acute effects on improving postmeal glucose excursions (13,14) and enhancing postmeal satiety (15) increased patients' perception of general control over their diabetes. The inability to approximate physiologic insulin secretory patterns and location with exogenous insulin, although much improved with the availability of rapid- and long-acting insulin analogs, is reportedly far from optimal (21). As illustrated by recent continuous glucose monitoring system studies (7,8) showing excessive postprandial glucose excursions even when insulin has been optimized with pump therapy, controlling postmeal hyperglycemia remains one of the more difficult aspects of intensive insulin management. Unfortunately, simply increasing the insulin dose at mealtime in an attempt to compensate for excessive postprandial peaks typically falls short of the desired effect and increases the risk of hypoglycemia and weight gain (21,22).

Several trials have demonstrated that improved flexibility in the daily therapeu-

Table 4—*Patient-reported outcomes by treatment group for insulin delivery method subgroups*

Question	Placebo (MDI $n = 68$; CSII $n = 68$)	Pramlintide (MDI $n = 54$; CSII $n = 76$)*	P value treatment
1) Made my blood sugar control more even or predictable			
MDI	3.45	4.02	<0.001†
CSII	2.84	4.26	
2) Provided me with more flexibility in what I can eat			
MDI	3.35	3.38	0.012†‡
CSII	2.47	3.41	
3) Made it easier to control my weight			
MDI	2.68	3.46	<0.001†
CSII	2.01	3.83	
4) Made it easier to avoid low blood sugar reactions (hypoglycemia)			
MDI	3.01	2.90	NS
CSII	2.51	2.76	
5) Made it easier to control my appetite			
MDI	3.04	3.87	<0.001†
CSII	2.29	4.07	
6) Had some side effects that would keep me from using it on a long-term basis			
MDI	1.77	2.38	0.004
CSII	1.72	2.17	
7) Provided benefits that insulin alone has not provided me			
MDI	3.14	4.02	<0.001†
CSII	2.37	4.39	
8) Reduced at least some of my worries about having diabetes			
MDI	2.94	3.15	0.003
CSII	2.31	3.22	
9) Made me feel more confident about managing my diabetes			
MDI	3.51	4.13	<0.001‡
CSII	2.94	3.89	
10) Provided me with enough benefit to outweigh the extra injections			
MDI	3.29	4.13	<0.001
CSII	2.59	4.12	
11) Improved my ability to function at home, at work, or at school			
MDI	3.00	3.53	<0.001†‡
CSII	2.21	3.03	
12) Improved how I feel overall			
MDI	3.26	3.85	<0.001
CSII	2.56	3.82	
13) I would like to continue taking the study medication			
CSII	4.22	4.53	<0.001
MDI	4.19	4.74	
14) I would recommend the study medication to other people with diabetes			
MDI	4.29	4.66	0.004
CSII	4.21	5.00	

*One pramlintide-treated subject changed their baseline insulin regimen (from MDI to CSII) during the study. †Significant interaction. ‡Significant treatment effect of delivery method. NS, not significant.

tic regimen, particularly increased dietary freedom, corresponds to enhanced treatment satisfaction in patients with diabetes engaging in intensified insulin treatment (23–25). Data from cross-sectional studies (26,27) have also indicated that poor postprandial glucose control leads to increased self-reported deterioration of mood and cognitive function in type 1 and type 2 diabetes. A recent double-blind, placebo-controlled investigation (28) evaluated the effects of acutely raising glucose using a hyperinsulinemic glucose clamp in a group of patients with type 2 diabetes. Intriguingly, performance on a series of cognitive tasks and self-reported mood state worsened after blood glucose was acutely raised to the hyperglycaemic range compared with the euglycemic range. Since patients were blinded to glucose readings, the results suggest the inability to control acute hyperglycemia after meals might affect well being.

Conclusions about treatment satisfaction in this study involve several limitations. Most importantly, the data reported are postintervention only, with no baseline for comparison. As such, we are not able to ascertain whether treatment

Table 5—*Percentage of patients indicating "agree" or "strongly agree" with each of the 14 survey items at 6 months postintervention during open label*

Survey item	29-week parent trial		Open-label extension	
	Placebo	Pramlintide*	Placebo → pramlintide†	Pramlintide → pramlintide*
1) Made my blood sugar more even or predictable	26.0	52.1‡	47.4§	59.1‖
2) Provide me more flexibility in what I can eat	21.2	26.6	39.8§	48.9‖
3) Made it easier to control my weight	7.7	37.2‖	51.3‖	43.2‖
4) Made it easier to avoid low blood glucose reactions	15.4	11.7	22.1	20.5
5) Made it easier to control my appetite	13.5	50.0‖	56.4‖	51.1‖
6) Had side effects that would keep me from using it on a long-term basis	2.9	7.4	7.7	6.8
7) Provided benefits that insulin alone has not provided	20.2	61.7‖	64.1‖	68.2‖
8) Reduced at least some of my worries about having diabetes	14.6	29.8§	28.2§	40.9‖
9) Made me feel more confident about managing my diabetes	32.7	54.2‡	47.4§	54.6‡
10) Provided me with enough benefit to outweigh extra injections	29.8	58.5‖	56.4‡	65.9‖
11) Improved my ability to function at home, work, or school	14.4	30.9§	29.5‡	40.9‖
12) Improved how I feel overall	22.1	51.1‖	39.8‖	55.7‖
13) I would like to continue taking study medication	74.0	85.1	74.4	80.7
14) I would recommend study medication to other people with diabetes	60.6	81.9‡	84.6‡	83.0‡

$n = 205$. *Compared with placebo in the parent study using Fisher's exact test. †Compared with placebo in the parent study using McNemar's test. ‡$P < 0.004$; §$P < 0.05$; ‖$P < 0.0001$.

groups differed significantly with respect to baseline treatment satisfaction measures. The relatively large sample size, however, helps mitigate this effect. These data are preliminary, using a measure that has not yet been validated. Despite these limitations, the treatment satisfaction results reported here are compelling and suggest that use of pramlintide potentially offers insulin-requiring patients a promising adjunct to traditional insulin therapy. Notable are the improvements in perceived control of both weight and appetite and improved predictability in glucose values that correspond to actual clinical outcomes (18). These elements address areas that are often difficult and stressful for patients with diabetes to manage. In this regard, the extent to which use of pramlintide might enhance patient efforts to achieve more optimal glycemic control is an interesting issue that deserves further investigation.

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