Inhaled Insulin Pediatric Study Reduces Post-Meal Hyperglycemia

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Kevin Kaiserman, MD, Senior Vice President, Therapeutic Area Head, Endocrine Diseases, for this educational event, has received employment and stocks from MannKind Corporation. The relevant financial relationships listed for this individual have been mitigated.

OBJECTIVE

To assess efficacy and safety in pediatric subjects of a higher starting dose of Technosphere® Insulin (TI) than the United States Prescribing Information (USPI)[1] compared to outcomes reported in adults with TI and rapid-acting insulin analogues (RAA) in the 2 hours following a standardized meal[2]

CONCLUSIONS

- The post-prandial glucose excursion with TI appears similar in pediatrics compared to reported outcomes in adults with TI and is substantially lower than the excursion following a bolus with RAA insulin
- No new safety signals with TI

INTRODUCTION

Inhaled Technosphere Insulin (TI) has an ultra-rapid acting profile, due to its unique pharmacokinetic and pharmacodynamic properties, resulting in a much faster time-to-peak effect and clearance compared to subcutaneously (SC) administered RAA.

A significant proportion of pediatric patients with type 1 diabetes are not achieving their glycemic targets. RAA mealtime insulin has a longer peak action that limits the ability to achieve 2-hour postprandial glucose targets without causing hypoglycemia 3-4 hours after the meal.

A study was undertaken to determine efficacy and safety of 6-12 month exposure to TI therapy in pediatric subjects, starting with a standardized meal challenge performed in-clinic using a modified conversion ratio from RAA than described in the USPI. This modified dosing conversion ratio has been shown in adult studies to improve postprandial glucose without any new safety concerns[2].

TI is approved for use in adults in USA and Brazil and is available in three color-coded dosage cartridges: 4U (blue), 8U (green), and 12U (yellow)[1].

METHODS

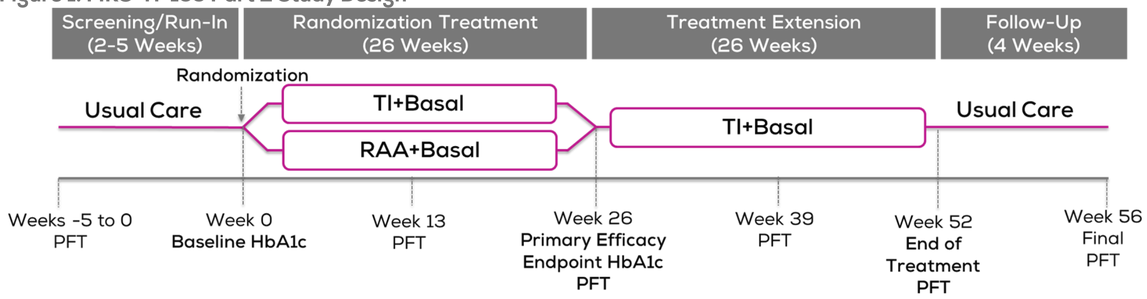
MKC-TI-155 Part 2 Study Design

MKC-TI-155 Part 2 is a Phase 3, open-label, randomized clinical study evaluating the efficacy and safety of TI + basal insulin versus insulin aspart, insulin lispro or insulin glulisine in combination with a basal insulin in pediatric subjects with type 1 or type 2 diabetes mellitus. Subjects were randomized and received 26 weeks of treatment according to their treatment group. 1) TI group: TI in combination with a basal insulin 2) RAA injection group: Insulin aspart, insulin lispro or insulin glulisine in combination with a basal insulin. Primary Endpoint: Change in HbA1c from baseline to Week 26, for noninferiority assessment. Complete study design is described in Figure 1.

MKC-TI-155 Part 2 Inclusion/Exclusion Criteria

- Age 4 to <18 years
- T1D or T2D on Insulin for 6 months (T1D) or 3 months (T2D)
- MDI for at least 2 weeks
- HbA1c ≥7.0% and ≤11.0%
- At least 2 units RAA per meal
- CGM use ≥70% over 2 weeks
- FEV1 or FEV1/FVC >80% of predicted GLI value

Figure 1. MKC-TI-155 Part 2 Study Design



Standardized Meal Challenge

Subjects participated in an in-clinic standardized meal and glucose excursion was monitored via CGM.

In the pediatric study, 113 subjects used TI at the start of the meal. The dose was determined by rounding the subject's usual RAA dose to the nearest whole number, multiplying by 2, and then rounding down to the nearest 4-unit dose of TI, Table 1.

In the adult study[2], 51 adults using RAA injections had a meal challenge using TI under similar conditions to the pediatric study. Additionally, 26 adults used their standard injected RAA insulin, dosed up to 15 minutes prior to the meal.

Table 1. Dose Conversion to TI (Pediatric Study)

Injected Mealtime Insulin Dose (RAA)	Converted Inhaled Insulin Dose (TI)
up to 3 units	4 units
4-5 units	8 units
6-7 units	12 units
8-9 units	16 units
10+ units	16 units

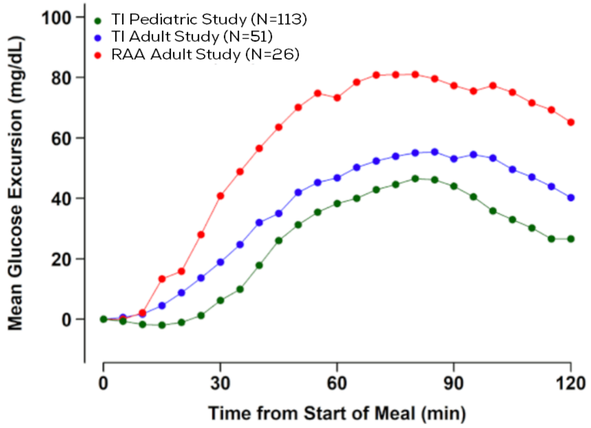
RESULTS

The post-prandial glucose excursion with TI appears similar in pediatric subjects to that which has been reported in adults following the standard meal, and both were substantially lower than the excursion following a bolus with RAA insulin in adults, Table 2.

Table 2. Meal Challenge Results

	Glucose Excursion, mg/dL, Mean (SD)	Time to Peak, min, Mean (SD)
TI, Pediatric Study	69 (56)	69 (34)
TI, Adult Study	73 (50)	71 (36)
RAA, Adult Study	101 (45)	78 (31)

Figure 2. Meal Challenge Outcomes



Safety

No new safety signals identified in the pediatric and adult studies.

MKC-TI-155 Part 2 primary outcome reported at ADA 2025 (Chicago).

1. Afrezza (insulin human) Inhalation Powder Prescribing Information. MannKind Corporation. Danbury, CT; February 2023.
2. Hirsch, et al. Diabetes Care. 2025; 48 (3): 353–360.
Original Presentation: "INHALED INSULIN IN PEDIATRICS (INHALE-1 PEDS STUDY)," presented at ATTD, 2025, Amsterdam, by Michael Haller.

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