

## Electrical Stimulation of the Gut for the Treatment of Type 2 Diabetes: The Role of Automatic Eating Detection

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### Abstract

#### **Background:**

Automatic eating detection (AED) can potentially support treatments that need to be synchronized with food intake. This article analyzes an implantable AED device working in conjunction with gastric stimulation intended to treat type 2 diabetes (T2DM). The device continuously senses for changes in tissue impedance and electrical activity induced by food intake and initiates treatment sessions upon detection. This article reviews AED performance as well as its relevance to treatment outcomes.

#### **Methods:**

Obese T2DM ( $n = 12$ ) were implanted with gastric leads and the TANTALUS<sup>®</sup> device. An AED algorithm was embedded in the device and was used to initiate periods of electrical stimulation during food intake. AED performance was assessed using patients' food diaries. The treatment outcome at 37 weeks postimplants was correlated with the rates of stimulation during large meals vs stimulation during periods of no caloric intake.

#### **Results:**

The algorithm was able to detect 73% of meals consumed while sensing. The rate of false stimulations was 28%. Stimulation during meals was significantly correlated ( $R^2 = 0.45$ ,  $p < 0.05$ ) with hemoglobin A1c change (average drop in hemoglobin A1c was  $-1 \pm 0.4\%$ ) but not with changes in body weight (average drop  $-4.7 \pm 2.8$  kg). Stimulation during periods with no caloric intake was negatively correlated with hemoglobin A1c reduction ( $R^2 = 0.27$ ,  $p < 0.05$ ).

#### **Conclusions:**

Sensing of gastric activity can be used for detection of food intake. The synchronization of gastric stimulation to periods of food intake is correlated with metabolic outcomes. AED may also benefit other applications such as drug delivery and control of food restriction devices.

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**Abbreviations:** (AED) automatic eating detection, (ED) eating detection, (FI) fundus impedance, (GLP-1) glucagon-like peptide 1, (HbA1c) hemoglobin A1c, (PPV) positive predictive value, (S) sensitivity, (SWR) slow wave rate, (T2DM) type 2 diabetes mellitus, (TP) true positive

**Keywords:** automatic eating detection, gastric stimulation, type 2 diabetes

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