RACP Foundation Research Awards

FINAL REPORT

Project Title	Comparison of vascular health status in people with Type 1 diabetes treated by multiple daily insulin injections or continuous subcutaneous insulin infusions (CSII) therapy
Name	Dr Emma Scott
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Chief Investigator / Supervisor	Professor Alicia Jenkins
Administering Institution	Centre for Remote Health
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PROJECT SUMMARY

People with Type 1 diabetes require therapy with insulin for life, and this can be administered via multiple daily injections or via an insulin pump (continuously delivering insulin via a connection under the skin). Recent evidence has shown that insulin pump therapy is associated with less long term diabetes complications, in particular heart and blood vessel disease. The reason for this benefit, may be because insulin pumps cause less fluctuations or variability in blood glucose levels over time. We aim to assess whether the method of insulin delivery (injection or pump) affects blood vessel and heart health in adults and children with Type 1 diabetes. We also aim to assess the effect of blood glucose variability in the development of diabetes complications in individuals with Type 1 and Type 2 diabetes.

PROJECT AIMS / OBJECTIVES

Assessment of glucose variability over the long term in adults with Type 1 diabetes treated by insulin pump or multiple injections of insulin at two Australian tertiary diabetes clinics.

2. Retrospective analysis of blinded continuous glucose monitoring data from all eligible adult individuals with Type 1 Diabetes from a tertiary diabetes clinic, and comparing between insulin modalities.

3. Cell culture analysis of the effect of glycaemic variability in vitro

4. Comparison of microRNA markers in a recently diagnosed paediatric population of Type 1 Diabetes, compared by insulin delivery modality

5. Analysis of glycaemic variability from adults with Type 2 diabetes from the (published) FIELD study, and the relationship of glycaemic variability to the development of diabetes complications.

6. Analysis of samples of paediatric individuals diagnosed with Type 1 Diabetes and randomised to continuous subcutaneous insulin infusion (CSII) and multiple daily injection (MDI), comparing markers of inflammation, beta cell death and vascular damage.

7. Samples from 36 adults and 24 adolescents from (published) ALGOS study, available for analysis of markers of inflammation and vasoactive substances and microRNAs

8. Analysis of data of samples and data from adult and adolescent subjects with Type 1 diabetes participating in one week and 6 month closed loop CSII study.

SIGNIFICANCE AND OUTCOMES

I have demonstrated that long term glucose variability reflected by changes in HbA1c (HbA1c CV and SD) is lower in individuals treated with CSII over time, and improves in adults changing from MDI to CSII therapy. This may be an explanation for the previously demonstrated lower rates of chronic diabetes complications in adults treated by CSII and will influence treatment choice for individuals with Type 1 diabetes. I have demonstrated, conversely that short term variability (over 48 hours) is no different in adults treated by CSII or MDI in the absence of continuous glucose monitoring. Therefore, a desire to improve day to day glucose fluctuations should not be the sole indication to commence CSII therapy. I have not yet completed the remainder of the PhD outcomes, however I hope that the results will elucidate the mechanism linking glucose variability to diabetes complications in both Type 1 and Type 2 diabetes, and that CSII therapy (in particular the new closed loop pump technologies) will facilitate less glucose variability and a reduce vascular complications.

PUBLICATIONS / PRESENTATIONS

Scott ES, McGrath RT, Januszewski AS, Fulcher GR, Jenkins AJ. Short term glycaemic variability in CSII vs MDI in adults with Type 1 diabetes. Accepted Abstract for the ATTD Vienna, February 2018.

Scott ES, McGrath RT, Januszewski AS, Calandro D, Hardikar AA, O'Neal DN, Fulcher GR, Jenkins AJ. Reduced HbA1c variability in adults with Type 1 diabetes on continuous subcutaneous insulin infusion (CSII) therapy compared to multiple daily injection (MDI) treatment. Currently under review at Diabetes Technology and Therapeutics

Scott ES, McGrath RT, Januszewski AS, Fulcher GR, Jenkins AJ Short term glucose variability in adults with Type 1 diabetes does not differ between insulin pump and multiple daily injection users- a masked continuous glucose monitoring study in clinical practice. Currently under review at Diabetes Research and Clinical Practice

Scott, E. S., Fulcher, G. R., & Clifton-Bligh, R. J. (2017). Sensor-augmented CSII therapy with predictive low-glucose suspend following total pancreatectomy. Endocrinology, Diabetes & Metabolism Case Reports, 2017, 17–0093. http://doi.org/10.1530/EDM-17-0093

Scott ES, McGrath RT, Januszewski AS, Calandro D, O'Neal DN, Fulcher GR, Jenkins AJ. Glycaemic variability in adults with Type 1 diabetes using continuous subcutaneous insulin infusion (CSII) compared with multiple daily injection (MDI) treatment. Poster presentation at the American Diabetes Association's 77th Scientific Sessions, San Diego 2017.

Scott ES, McGrath RT, Januszewski AS, Calandro D, O'Neal DN, Fulcher GR, Jenkins AJ. Glycaemic variability in Type 1 diabetes patients is better with continuous subcutaneous insulin infusion (CSII) therapy than with MDI treatment. Presented at the Australian Diabetes Society President's Clinical Young Investigator Award. ADS 2016.