Changes in simple indices of glycaemic variability associated with structured self-monitoring of blood glucose in people with non-insulin treated type 2 diabetes

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Introduction

Structured self-monitoring of blood glucose (SMBG) is advised in the management of non-insulin treated type 2 diabetes (T2D), in particular circumstances[1].

Aims

To examine the impact of structured SMBG on simple indices of glycaemic variability (GV) [standard deviation of blood glucose (SD-BG), coefficient of variation of blood glucose (CV-BG), mean absolute glucose change (MAG)] in addition to glycaemic control [HbA1c, fasting blood glucose (FBG) and mean blood glucose (M-BG)] in people with non-insulin treated T2D.

To compare baseline characteristics and glycaemic control between participants who did and did not derive a clinically significant improvement in glycaemic control with SMBG.

Methods

People with non-insulin treated T2D undertook structured SMBG for 12 months, consisting of twice weekly paired BG testing during the day with a 3 day 7-point profile at end of each 3 month period. HbA1c was determined at 0, 3, 6, 9 and 12 months[2]. The individual M-BG, FBG and GV indices: SD-BG, CV-BG, and MAG and were calculated for each subject at baseline and over 3-monthly intervals during the 12 month study. Data were not normally distributed and are presented as the median [interquartile range].

Responders were defined as participants with an improvement in HbA1c of ≥5mmol/mol over 12 months.

Results

Two-hundred and thirty-one T2D people with a mean age 63.9 years (56.7% male) and median [IQR] baseline HbA1c 68.0 [61.5-75.5] mmol/mol (8.4%) were included.

At 12 months follow-up, when compared with baseline, there were statistically significant improvements in HbA1c, M-BG, FBG, and indices of GV SD-BG, CV-BG and MAG. These data are presented in Table 1 and Figure 1.

Responders had a significantly higher baseline HbA1c compared to non-responders. There were no significant differences in age, gender, previous SMBG use or duration of diabetes between responders and non-responders. These data are presented in Table 2.

Table 1: metabolic parameters and GV at baseline & 12-month follow up

	Baseline	12 months	P-value
HbA1c	62.0 [55.0-69.0]	55.0 [49.0-62.0]	<0.001
FBG	9.0 [7.8-10.4]	8.0 [7.2-9.3]	<0.001
M-BG	9.7 [8.7-11.2]	8.4 [7.5-9.6]	<0.001
SD-BG	**2.5 [2.0-3.0]**	**2.0 [1.6-2.5]**	**<0.001**
CV-BG	**24.8 [21.3-28.5]**	**23.4 [19.9-27.2]**	**<0.001**
MAG	**1.8 [1.0-2.7]**	**0.9 [0.2-1.8]**	**<0.001**

Median [IQR] shown. P values from Wilcoxon Signed rank test.

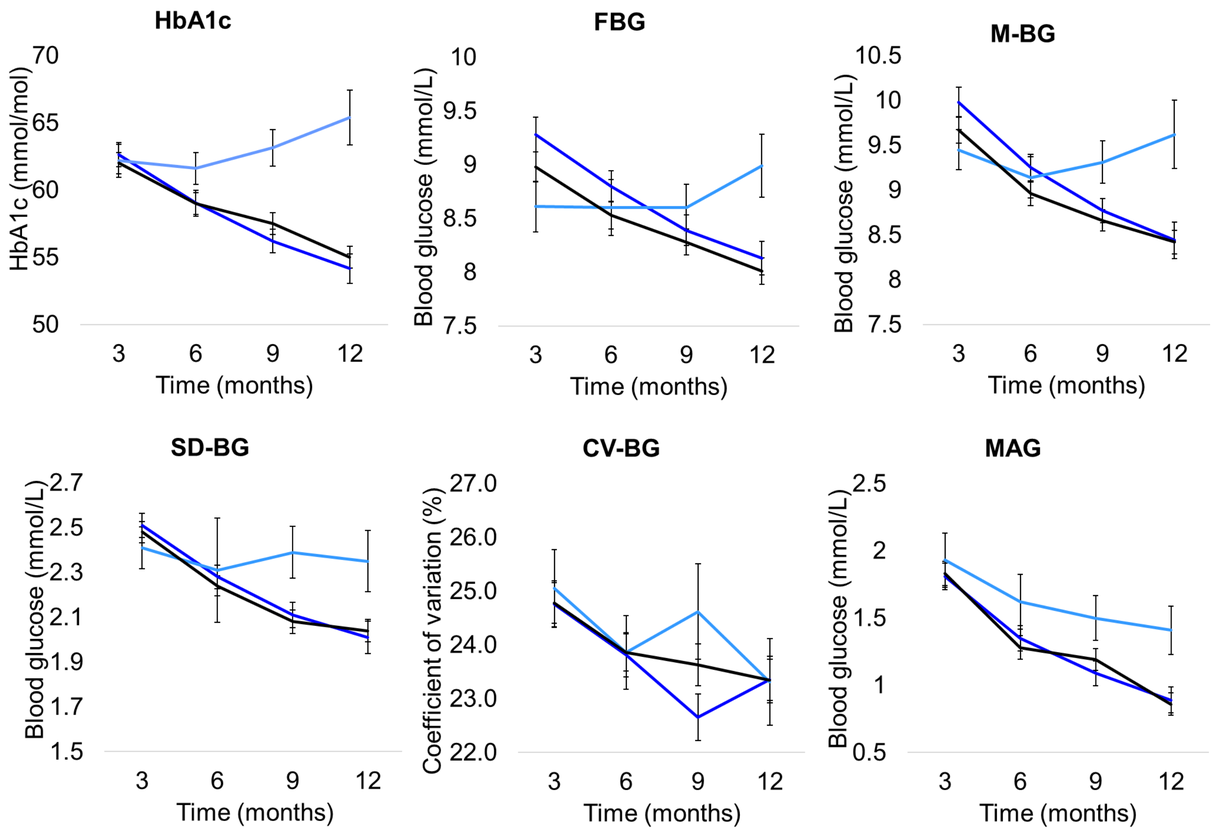
Results continued

Table 2: Baseline characteristics by responder status

	Non-responder (n=47)	Responder (n=156)	P-value
Age (years)	64.5 [60.0-68.6]	64.0 [55.7-68.3]	NS
Male	27 (57.4%)	90 (57.7%)	NS
Previous SMBG use	37 (78.7%)	105 (67.3%)	NS
T2D duration >5 years	34 (72.3%)	97 (62.2%)	NS
HbA1c (mmol/mol)	61.0 [56.5-66.0]	70.0 [63.0-78.0]	<0.001

Median [IQR] shown. P values derived from Mann-Whitney test. NS = Non-significant

Figure 1: Changes in metabolic and GV at 3-monthly intervals over 12 months



Line graphs illustrate improvements in GV in 3-monthly intervals over the 12 month period. Data presented as the mean and error bars represent the standard error of the mean. Black line: all participants, dark blue line: responders, light blue line: non-responders.

Conclusion

The introduction of structured SMBG in persons with non-insulin treated T2D was associated with a significant improvement in simple indices of GV along with improvement in glycaemic control over a 12 month study period.

Participants with a clinically significant response to structured SMBG had a statistically significantly higher baseline HbA1c compared to non-responders.

In clinical practice the additional use of simple indices of GV such as SD and CV derived from structured SMBG in persons with T2D may help to individualise diabetes treatment. The advent of continuous glucose monitoring presents further opportunities to evaluate the potential use of these and other indices of GV in applying ‘precision medicine’.

References

1. NICE. (2017). Type 2 diabetes in adults: management. NICE guideline [NG28]. Available at: https://www.nice.org.uk/guidance/ng28/chapter/1-Recommendations

2. Parsons *et al.* BMC Endocrine Disorders 2017;17:4