NON-INVASIVE GLUCOSE MONITORING BY A RAMAN SPECTROSCOPY-BASED PROTOTYPE AFTER MEAL CHALLENGE IN TYPE 1 DIABETES

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Background and Aims

One of the most promising technologies for non-invasive glucose monitoring (NIGM) in diabetes is Raman spectroscopy. We assessed the performance of a novel prototype (figure 1) in comparison with standard capillary blood glucose monitoring (BGM) and intermittent scanning continuous glucose monitoring (iscCGM).

Method

In total, 15 subjects with type 1 diabetes underwent a carbohydrate-rich meal (figure 2) challenge during which BGM, iscCGM and NIGM measurements were performed every 15 min for 450 min. Measurement values with all monitoring systems since start of test meal to 60 min after meal intake were available for 12 subjects.

Figure 1: Prototype system device for NIGM.

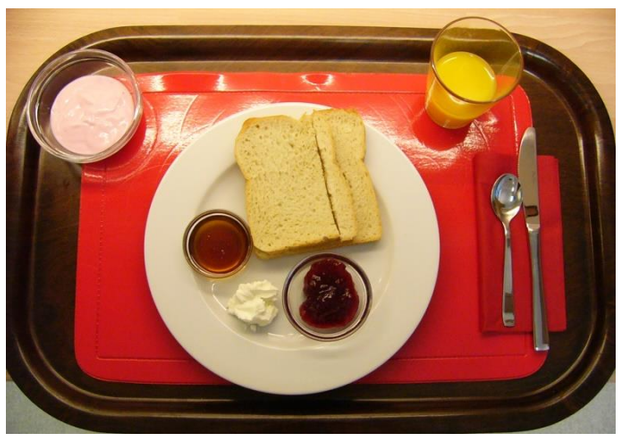

Figure 2: Carbohydrate-rich meal (20% of daily energy requirement, 80% carbohydrates).

Results

Mean glucose values for the 3 monitoring systems are shown in figure 3 and figure 4 exhibiting a good match. The closeness of agreement generally improved with lower rates of change.

During the initial 60 min after the standardized meal, the rates of change were: BGM, 2.0 ± 1.7 mg/dl/min, iscCGM, 1.5 ± 1.2 mg/dl/min, and NIGM, 0.8 ± 1.5 mg/dl/min (mean ± standard deviation) (table 1). Time in range (TIR) for the three monitoring systems was calculated as well and is displayed in figure 5.

Conclusion

In this proof-of-concept study, average glucose concentrations using NIGM showed good agreement with mean BGM and iscCGM data. The glucose readings seemed to show better agreement during lower rates of glucose change.

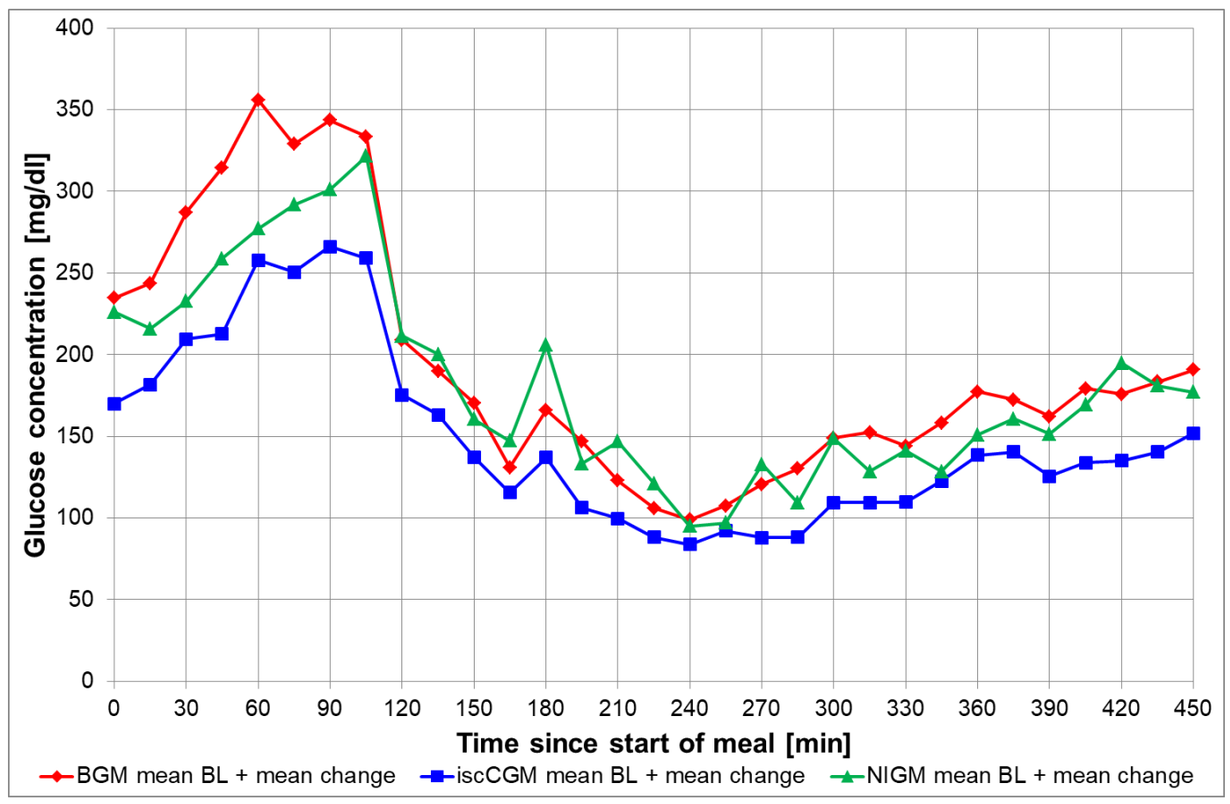

Figure 3: Mean glucose values during the meal challenge for BGM (red), iscCGM (blue) and NIGM (green) since start of carbohydrate-rich meal (n=12).

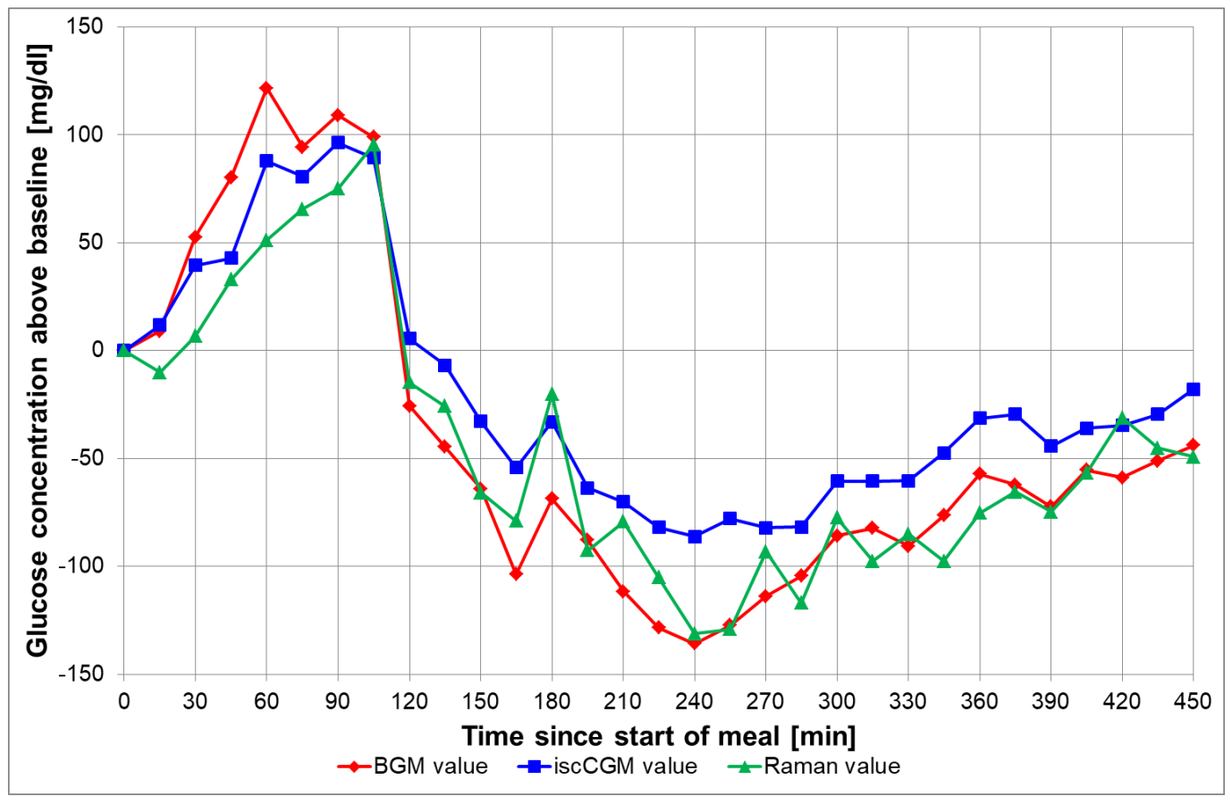

Figure 4: Glucose change above baseline during the meal challenge for BGM (red), iscCGM (blue) and NIGM (green) since start of carbohydrate-rich meal (n=12).

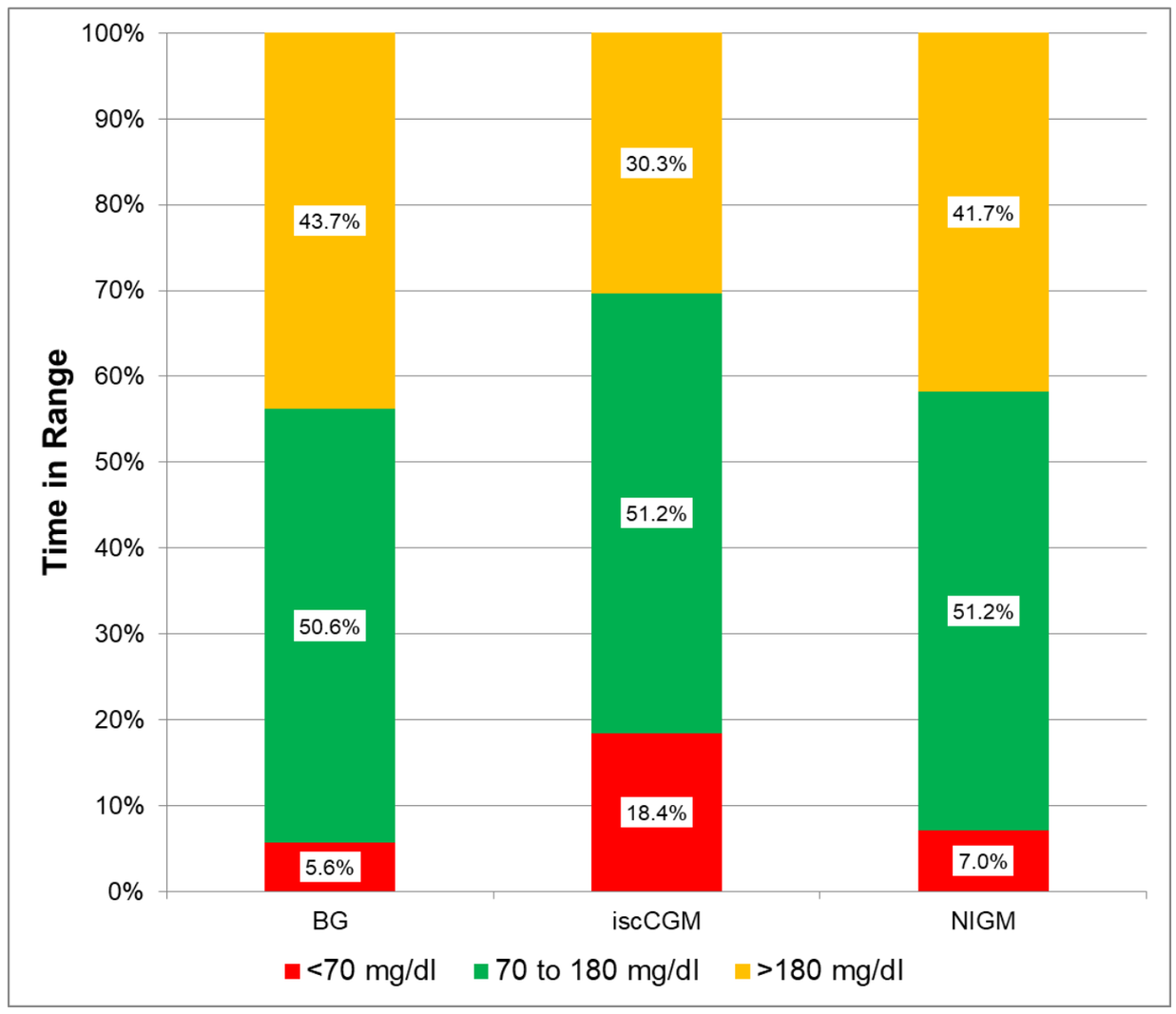

Figure 5: TIR during the meal challenge for BGM (left), iscCGM (middle) and NIGM (right) (n=15).

Table 1: Mean and standard deviation (SD) of glucose concentration rates-of-change for BGM, iscCGM and NIGM (n=12) 60 minutes after meal.

	Mean [mg/dl/min]	SD [mg/dl/min]
BGM	2.0	1.7
iscCGM	1.5	1.2
NIGM	0.8	1.5

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