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REVIEW ARTICLE

Lancing: *Quo Vadis?*

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Abstract

Today, lancing fingertips or alternative sites for obtaining a blood sample for self-monitoring of blood glucose (SMBG) is a standard procedure for most patients with diabetes. The need for frequent lancing and associated discomfort and pain can be seen as a key hurdle for patients to comply with SMBG regimens. This article provides an overview of the *status quo* and future of lancing, focusing on key areas for future developments driven by customer and market needs. We also review technical issues and provide a background for possible improvements.

The act of puncturing the skin with a lancet to obtain a blood sample seems to remain the standard procedure for the foreseeable future, because alternate ways of providing a blood sample have not demonstrated overall superiority (e.g., with laser technology). Other methods, which avoid lancing entirely, have also not gained broad market acceptance (e.g., minimally invasive continuous glucose monitoring) or not shown technical viability (e.g., noninvasive glucose monitoring).

In relation to blood glucose (BG) meters and test strips, lancing has been a "stepchild" with regards to commercial attention and development efforts. Nevertheless, significant technological improvements have been made in this field to address key customer needs, including better performance (regarding pain, wound healing, and long-term sensitivity), reduced cost, and higher integration with other components of BG monitoring (e.g., integration of the lancing device with the glucose monitor). From a technical perspective, it is apparent that highly comfortable lancing can be accomplished; however, this still requires fairly advanced and complex devices. New developments are necessary to achieve this level of sophistication and performance with less intricate and costly system designs. Manufacturers' motivation to pursue these developments is compromised by the fact that they might not recoup their development cost on commercial advanced lancing systems through direct profits, but only through its positive influence on adherence and increased more profitable sensor utilization.

We believe that two main driving forces will continue to push the evolution of lancing and sampling technology: (1) the need for maximum lancing comfort and (2) the advent of fully integrated systems, realizing a device in which all steps for SMBG are incorporated, thus providing a "one-step" experience. Rendering lancing a "nonissue" will eliminate a key barrier to adherence with appropriate SMBG regimens. Providing sophisticated lancing devices that allow the highest level of comfort and/or seamless blood sampling is key to improving user acceptance. This may have a greater impact on metabolic control than many of the new and expensive antidiabetic drugs.

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Abbreviations: (A1C) glycated hemoglobin, (AST) alternate site testing, (BG) blood glucose, (CDE) certified diabetes educator, (CGM) continuous glucose monitoring, (HCP) health care provider, (SMBG) self-monitoring of blood glucose

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