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COMMENTARY

Finger Pricking and Pain: A Never Ending Story

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Abstract

Without finger pricking, no self-measurement of blood glucose (SMBG) is possible. However, the number of scientific studies dealing with this topic, which is highly relevant for patients, is surprisingly small. This is in sharp contrast to the number of papers about blood glucose meters and SMBG in general. This article highlights a number of aspects that are relevant when it comes to finger pricking and pain. There is a clear improvement in the technology employed in the many different lancing devices that are on the market nowadays; however, no good head-to-head comparison study has been performed to date. The invention of novel devices for finger pricking will most likely bring more attention to this topic.

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Introduction

If you enter the terms self-measurement of blood glucose (SMBG) and pain for a literature search into PubMed, you will be surprised by the very small number of publications found ($n = 7$). If you check these hits, only three of them deal with studies about this topic in reality.[1–3] Interestingly, other search terms also do not provide more citations about the pain associated with finger pricking.[4–7] Thus, it appears as if there are only a very limited number of publications about this topic. This might also be the reason why only one review on this topic has ever been published,[3] which is a very small number in relation to the many reviews on SMBG in general. However, most of these focused on the measurement procedure and the measurement quality of the blood glucose (BG) meters. Interestingly, half of the publications about finger pricking and pain were published by authors working for companies that manufactured lancing devices, e.g., the review just mentioned. Thus, one has to acknowledge that this aspect, which is highly relevant for patients, has been more or less ignored by academic research!

This is in sharp contrast to the fact that millions of patients prick their fingers day after day and experience pain each time (imagine the number of little "ouches"). Patients use conventional lancets or devices specifically designed for patients with diabetes to make this procedure less painful. One has to acknowledge that not only has the pain of insulin injection been reduced considerably by developing thin and sharp needles in the

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Abbreviations: (AST) alternate site testing, (BG) blood glucose, (SMBG) self-measurement of blood glucose

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last decades, but the pain associated with finger pricking has also been reduced, though not completely eliminated.[1] In the most recent issue of the *Diabetes Forecast Resources Guide* 2008, 64 of such lancing devices are listed. Thus, for the companies this is a market. However, in contrast to the high number of advertisements for different BG meters in each and every diabetes journal, the number of advertisements about lancing devices is relatively small. In view of the number of lancing devices, why is there no recent head-to-head comparison study that critically investigates the pain induced by the different lancing systems?

Why has there been such a low interest in finger pricking—at least in academia—over the years? Is it simply because the overall market for such devices, despite the number of devices offered, is a relatively small market as compared to the market for BG meters and test strips? The global turnover for these diagnostic devices is in the range of $7 billion per year, but it is not clear what the market size for lancing devices is. Company representatives state that their reason for not investing in clinical trials (at least in studies that were published subsequently) is the small profit margin with lancing devices. However, one could assume that companies invest in clinical trials about this topic for marketing reasons, but as a matter of fact this is not the case.

In contrast to limited public knowledge, a large amount of technical knowledge has been accumulated by companies individually. They have performed many development studies about the optimal shape of the needle tip, about how to polish the needle, and how to guide the needle while penetrating the skin in order to reduce the pain while pricking the finger. It appears as if vibrations of the needle tip while penetrating the skin and the depth of needle penetration are key for pain induction. Taking care of these aspects explains why the pain associated with finger pricking is reduced enormously with modern lancing systems.

One practical issue of lancing devices is that changing the actual lancet in the lancing device (i.e., the disposable part) requires a certain amount of visual and mechanical capability with many systems. This can be an issue for many elderly patients. For such patients, easy handling of the finger pricking procedure is essential. The systems on the market differ in this respect considerably; however, again, this has not been studied extensively. Novel devices coming to the market declare that their innovative technology greatly reduces the pain associated with finger pricking and that they are easy to handle at the same time (www.pelikantechnologies.com). Let's hope that such a newcomer brings fresh interest in this topic, as most likely this has an impact on our attitude toward the lancing aspect in general.

If you are interested in learning about how patients perform finger pricking in daily life, you will also find a very limited number of studies. In a recently published survey of approximately 1000 patients with type 1 and type 2 diabetes, half of them stated that they use the less painful lateral side of the fingertip for finger pricking (51%).[9] However, nearly one-third of the patients use the center of the fingertip (31%) for finger pricking, the site associated with the greatest pain. Any site of the finger (whatever this means) is used by 12%, and 5% use other parts of the body to gain the blood drop. Assuming that the sharpness of the needle tip is decreased rapidly with multiple uses (I heard conflicting statements about this, probably depending on the fact if you are a producer or a payer) it is also of interest to see how often a given lancet is used by these patients for finger pricking: only 10% use it once, 19% use them 2–4 times, 22% use them 5–7 times, 25% use them 8–10 times, and 21% use them 11 times or more often! It would be quite interesting to see more data about the reality of finger pricking; data reported by patients who are willing to answer a questionnaire might be biased and it is also of note that this survey (which focused on the measurement step of SMBG and was published in German only) was supported by one of the big diagnostic companies.

Pricking the finger tip several times per day for many years/decades is not only annoying to the patient but also has certain consequences: (1) development of massive scarring/callous formation and (2) loss of sensibility/perception hindrance. The pain associated with finger pricking is most probably the main reason (besides the costs) why patients refrain from SMBG. In turn, such a reduced measurement frequency has a negative impact on metabolic control. The pain might also induce a negative perception against diabetes and its therapy in general. Keep in mind how difficult it is to convince children to measure BG levels several times a day. This induces a lot of trouble in families with diabetic children. Most likely it is more the finger pricking that is the negative symbol for diabetes than the (more or less pain free) subcutaneous injection of insulin. It might not be a nice comment; however, if diabetologists/scientists would have to prick their fingers several times a day, this probably would change their attitude about finger pricking somewhat.

The results of the survey reported earlier also raise the question how much training patients receive in this specific aspect of SMBG during the diabetes teaching program. It appears as if finger pricking (and all the other steps involved in a successful performance of SMBG) should be given more attention in such programs. Are the patients instructed in the optimal (i.e., least painful) use of the lancing device? There is a clear association of the depth of insertion of the lancet with the pain induced. Depending on the thickness of the skin of the individual patient, the depth has to be varied adequately to find a balance between obtaining a blood drop with an optimal size and the least possible pain induction.

In order to avoid the pain of finger pricking, one straightforward approach developed some years ago was to obtain the blood drop at other sites. Pricking the skin at the abdomen, arm, or thigh [i.e., alternate site testing (AST)] gained some popularity for a while. A number of blood glucose meters were developed and marketed that were declared to be optimized for AST measurement (e.g., the AtLast system by Amira Medical; see Yum and Rose[3]). In reality, I wonder how many patients use such skin sites nowadays to obtain a blood drop. No data about this topic have been published to my knowledge. Pricking the skin at such sites might be associated with reduced pain; however, the resultant blood stains in the skin and the difficulty of pricking in public reduce the attractiveness of this approach. Also the different attempts to collect interstitial fluid from the skin as a source for BG monitoring were not successful until now, i.e., no product relying on this fluid is on the market.

Another idea was to use a laser, which burns a little hole into the very upper layers of the skin only, thereby avoiding pain perception. However, the device needed to generate such a laser beam was bulky and expensive. In addition, the "side effects" of "shooting" at the skin (a loud bang, a little cloud of smoke, and some smell) generated so much attention that most patients were not willing to use this device in public. Therefore, this device was not a market success as well.

The first blood glucose meters are now on the market that combines a lancing device with the meter. This eases handling of the measurement procedure, but does not alleviate the pain while pricking the finger. Other systems in development (one has been on the market, but was too bulky and tricky to handle) for the most part combine all of the steps of SMBG. Once the device is placed on the skin, the skin prick is initiated automatically, an appropriate blood sample is collected by the system, and the measurement is initiated. The patient has only to read the measurement result and to act appropriately. That many patients do not analyze the current blood glucose value and translate them into appropriate therapeutic actions is a different but important story (see the aforementioned survey). You might hope that increased use of continuous glucose monitoring will end the need for finger pricking. However, insertion of the glucose sensors is associated with at least some pain as well and—more importantly—all sensors available today require calibration of the measurements by at least one conventional blood glucose measurement per day.

In summary, making finger pricking a less annoying procedure is not only making this more convenient, if it reduces the barrier toward to a more frequent measurement, this might have a greater impact on metabolic control than many of the (new) antidiabetic drugs. Thus, from my point of view, much more attention should be given to the pain associated with finger pricking.

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