Pain, distress and blood glucose monitoring

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ARTICLE POINTS

1 There are significant barriers to self blood glucose monitoring (SBGM).

2 Patient diaries have revealed that SBGM involves both physical pain and emotional 'pain'.

3 Vacuum-assisted alternative site blood testing reduces physical pain.

4 Further studies are needed to evaluate people's attitudes to SBGM.

5 We also need to understand how SBGM affects quality of life.

KEY WORDS

- **Self blood glucose monitoring**
- **Survey**
- **Alternative site testing meters**
- **Quality of life**
- **Diabetes management**

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Introduction

For people with diabetes there are several barriers to self blood glucose monitoring (SBGM), of which the pain of pricking sensitive fingers is a significant one. A recent survey asked people with diabetes to compare a new vacuum-assisted blood glucose meter, which can be used on other areas of the body, with their usual meter. Study participants were provided with a diary to record their experiences. Not only was less pain an advantage for most people, but also their comments revealed some interesting perspectives on SBGM.

For most people diagnosed with diabetes, there is not only an immediate requirement for medical intervention, but also the need to commit to considerable adjustments in lifestyle. One of the first things patients learn is that they can no longer eat whatever they want, whenever they want, without considering how this will affect their blood glucose and their insulin requirements. This can have a major impact on their life, because not only do they need to accommodate blood glucose monitoring into their everyday life, they also have to deal with their own emotional response to having diabetes – a lifelong condition.

Tight blood glucose control is now recognised as being crucial to the optimal management of diabetes. Low blood glucose produces unpleasant feelings and the risk of losing consciousness, while high plasma glucose can impair cognitive function and is accompanied by the risk of diabetic ketoacidosis/hyperosmolar coma. However, the warning signs preceding these conditions are not always obvious to the individual. Furthermore, as we know from the results of the UK Prospective Diabetes Study (UKPDS, 1998) and the Diabetes Control and Complications Trial (DCCT, 1993), tight blood glucose control significantly reduces the long-term microvascular and macrovascular complications of diabetes.

Despite all this, blood glucose control remains poor in a significant number of people with diabetes – evidence of the difficulty of this task. Recent data from three countries indicated that >60% of patients with type 2 diabetes have HbA_{1c} >7.5% (Nattrass, 2000). Soon after diagnosis, people with diabetes receive education on how to measure their blood glucose and, if appropriate, how to tailor their insulin dosage to match their food intake and exercise levels. Anecdotally, during this time, patients put considerable effort into monitoring their blood glucose. But, as time passes, adherence to these regimens dwindles and glucose monitoring becomes desultory, erratic and less than optimal.

Barriers to SBGM

The reasons for poor glucose monitoring have been explored (Polonsky, 1999; Rubin and Peyrot, 2001), and barriers to self blood glucose monitoring (SBGM) have been shown to be multifactorial. The pain of constant finger-pricking and the inconvenience of having to perform blood glucose measurements have been identified as two of the barriers to SBGM.

Traditionally, a finger is used for blood testing – it is easily accessible, has a rich blood supply and allows blood to be placed on test strips easily. The finger, however, is also very sensitive, so that continuous pricking results in pain (Carley et al, 2000). The ability to use other sites that are less painful, such as the side of thumb, is therefore likely to be appealing (Loveland et al, 1999).

An awareness of the significant barrier imposed by the pain of constant finger

pricking has provided the impetus for the development of less painful methods of blood sampling. Considerable scientific effort is being devoted to non-invasive methods of SBGM (Taylor, 1999), but the technical challenge of these systems makes the reality, for most, some way off.

Alternative site testing meters

More encouraging is the latest generation of alternative site testing meters, which are able to use blood from any convenient site in the hand or forearm. Because these areas of the body have a less dense sensory innervation than the fingers, they are less painful to use. In addition, the area suitable for use with alternative site testing meters can be varied far more than when using conventional methods.

One randomised study has shown that forearm sampling is less painful than finger pricking (Cunningham et al, 2000). Importantly, blood glucose concentrations are essentially the same in the finger as in the forearm (Fineberg et al, 2001; Lock et al, 2002), so that it is quite acceptable to use forearm blood for SBGM. However, there are exceptions: for example, finger blood is preferred in situations when the individual is rapidly becoming hypoglycaemic (McGarraugh et al, 2001).

Current study

The company MediSense® have manufactured SoftSense™, a vacuum-assisted meter. This is an 'all-in-one device', which means that the lancet and test strip sit inside the meter. A touch of the button activates the lancet and an automated vacuum draws blood directly onto the test strip. This unique approach to sample collection means that SoftSense™ can be used at any time, even when glucose levels are changing in the body.

In an attempt to obtain user feedback on SoftSense™, MediSense® provided new users with a 'User Familiarisation Diary' in which to record their experiences of the meter compared with their old meters.

Methods

Meters were distributed to diabetes specialist nurses at clinics and hospitals throughout the UK. During October and November of 2001, individuals with diabetes, or their parents in the case of children, were given a diary to complete. This involved recording details of their blood glucose and, importantly, included a response section that asked questions about how the new meter compared with the patients' old meters (see examples in *Figure 1*), as well as a section for open comments. Participants were asked

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1 Alternative site testing meters can use blood from any convenient site in the hand or forearm.

2 To obtain feedback on a vacuum-assisted meter, new users were asked to complete a 'User Familiarisation Diary'.

3 Patients recorded details of their blood glucose, and their thoughts about how the new meter compared with their old meters.

SoftSense™ feedback

What was the level of comfort you perceived when testing with your current finger-pricking method?
(1=absolutely painless, 6=very painful) 1 2 3 4 5 6

Which glucose meter do you currently use? .....

What was the level of comfort you perceived when testing with SoftSense™?
(1=absolutely painless, 6=very painful) 1 2 3 4 5 6

How do you find ease of use when testing with your current method?
(1=very easy, 6=very difficult) 1 2 3 4 5 6

How do you find ease of use when testing with SoftSense™?
(1=very easy, 6=very difficult) 1 2 3 4 5 6

Based on your experience, would you now use SoftSense™ as your regular blood glucose meter? .....

Figure 1. Examples of questions included in the response section of the diaries given to patients with diabetes to evaluate their thoughts on the SoftSense™ meter.

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1 A total of 127 diaries, containing 12391 blood glucose readings, were reviewed.

2 Patients reported experiencing less pain when using the SoftSense™ meter compared with finger stick testing.

3 The diaries highlighted that coping with the physical pain can be associated with significant emotional distress.

4 The fact that the device could be used single-handedly was a huge bonus for three users who had suffered strokes.

to return their diaries upon recording 100 blood glucose readings.

Results

Physical pain

A total of 127 diaries, containing 12391 blood glucose readings, were reviewed by ourselves and MediSense®. The majority of people were performing more than 15 blood glucose tests per week. People reported experiencing considerably less pain when using the SoftSense™ meter compared with finger stick testing.

Patients' perceptions of comfort and ease of use of their previous meters compared with the vacuum-assisted meter are summarised in *Table 1*.

When asked whether, based on their experience, they would now use SoftSense™ as their regular blood glucose meter, 83% replied 'Yes' (8% said 'No'; the remainder either did not answer the question or replied 'Don't know'). One user described SoftSense™ as:

'…a painless, easy machine which I loved.'

Less painful monitoring was not only welcomed by the majority of patients, but also, for some, had a significant effect on their ability to monitor their blood glucose.

Surprisingly, for three users, this meter enabled them to return to SBGM, which they had previously abandoned. For one patient, who had been diagnosed for 6 years, it was the first time she had ever been able to use a blood glucose meter as her fingers were too sensitive. Other comments included:

'I had previously given up blood glucose monitoring due to very sensitive finger tips and the pain of finger pricking … I am now testing on a regular basis and this has enabled me to control my blood sugar levels effectively for the first time in several years.'

'It's nice to have my fingers back.'

Table 1. Comparison of the SoftSense™ meters with patients' old meters, with respect to comfort and ease of use

	Previous meter	SoftSense™ meter
Level of comfort* (6=very painful; 1=absolutely painless)	3.93 ±1.46 (n=119)	1.62 ±0.75 (n=199)
Ease of use (6=very difficult; 1=very easy)	2.80 ±1.48 (n=117)	1.94 ±1.17 (n=120)

Values are average ±SD; *P<0.001 Student's *t*-test

Emotional 'pain'

Interestingly, the diaries highlighted that coping with the physical pain can also be associated with significant emotional distress. For instance, one patient wrote:

'…had given up using old method as had built up a dread of using it.'

The 'dread' of the pain associated with SBGM is no doubt a barrier to effective testing, which is reinforced with time as the painful experience is repeated. Constant pain can be at best annoying and at worst a constant drain on the individual's emotional resources, leading to low morale or even depression.

Perception of pain is also influenced by factors such as the meaning of the pain and the degree to which patients feel they have control over that pain (reviewed in Hawthorn and Redmond, 1998). In this context, the pain associated with repeated glucose monitoring could serve as a reminder of the person's diabetes and their frustration at having to constantly try to control these physiological parameters. This can have an overall negative impact on the individual, 'for every chronic disease challenges the patient with a new identity over which they have no control, but by which their lives are defined in some way' (Snoek, 2000).

Although this survey has shown that being able to reduce the physical pain has the potential to reduce a barrier to monitoring, the diaries have also highlighted other contributory factors that need to be considered when providing patients with a monitoring device. For the 8% of users who replied 'No' to the question of whether they would continue using the new meter, their reasons for not wanting to use it were related to other factors, such as the size of the device, rather than physical pain.

The fact that a vacuum-assisted method can be used single handedly was a huge bonus for three users who had suffered strokes, which impaired their manual dexterity and

made SBGM using finger stick methods very difficult. Quite poignantly, a mother of a child with cerebral palsy and poor hand–eye coordination found that her son was able to perform his own blood glucose measurements for the first time:

'The meter has been of outstanding success and has given a disabled person another measure of independence.'

The embarrassment of having to perform blood glucose monitoring in public places was also revealed by the diaries, in which the following comments were written about SoftSense™:

'It was better to use in public because there was no blood in view.'

'It wasn't discreet and when I took it to school I found it hard to do it discreetly.'

'Not very convenient for testing at work whilst wearing blouses and suits.'

Recent studies have evaluated alternative site testing glucose meters compared with the finger stick method in terms of pain and patient preference (Fineberg et al, 2001; Bennion et al, 2002). The Bennion study showed that although pain decreased, the testing frequency did not increase. This highlights the fact that few studies have explored how individuals feel about having to monitor at all, and how this impacts on their wellbeing, their attitude to their diabetes, their compliance with treatment and, ultimately, their blood glucose control.

Conclusions

Addressing physical pain is clearly of paramount importance for getting people with diabetes to monitor their blood glucose regularly. However, consideration also needs to be given to other issues such as embarrassment and the need for discretion. It is crucial that these distressing aspects of SBGM are addressed, as performing blood glucose monitoring can remind patients of their emotional responses to their disease several times a day.

As these diaries have shown, newer devices such as the SoftSense™ meter are helping to reduce the level of both the physical and emotional pain that often accompany diabetes management.

Importantly, these diary observations have highlighted the value of performing detailed surveys of patients' concerns and attitudes to blood glucose monitoring. Such studies should include properly validated quality of life scales to probe more deeply into the acceptance of SBGM by individuals with diabetes, past the level of physical pain experienced. Such instruments have been developed (Jones et al, 1996), but are rarely used.

Once all the barriers to SBGM that affect patient attitudes and their levels of distress are taken into account, maybe the issue of effective self-management using SBGM can be addressed in a more holistic, person-orientated manner. ■

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1 The diaries also revealed that people were embarrassed if they had to monitor their blood glucose in public places.

2 In another study, although pain decreased with the use of alternative site testing meters, testing frequency did not increase.

3 Newer devices are helping to reduce the level of both the physical and emotional pain that often accompany diabetes management.

4 This study has highlighted the value of performing detailed surveys of patients' concerns and attitudes to blood glucose monitoring.