Pain in connection with capillary blood test at different sites in the palm

H Grill-Wikell, M Annersten, A Frid*

Abstract

There are studies suggesting that fear of blood and injury is associated with less frequent self-testing; by reducing pain when measuring blood glucose the number of measurements can probably increase.

The aim of this study was to investigate whether or not there were any differences regarding pain at different test sites in the palm.

Twenty type 1 diabetes subjects pricked themselves at four different sites in the palm in the non-dominant hand in a randomised order with the Freestyle® punction device loaded with BD Microfine+ lancets. Pain was evaluated by the subjects using the Pain-O-Meter®.

The result (n=80) showed no statistically significant difference in pain score between the investigated sites.

The level of sensory pain was reported: shooting (n=36), no pain (n=27), searing (n=8), soaring (n=5), pressing (n=2), aching (n=1) and burning (n=1); 86% (n=69) of the pricked sites were experienced as no pain at all.

This study shows that pain in connection with capillary blood test is low as measured by the Pain-O-Meter. There are no significant differences in the pain experienced at different sites in the palm. More studies need to be done using different punction devices and more sites need to be investigated.

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Key words

blood glucose self-monitoring; pain measurements; capillary blood test; test-sites; Pain-O-Meter®

Background

Pain in connection with capillary blood testing may be a reason for avoiding home self-monitoring of blood glucose (SMBG). Regular blood glucose measurements are the prerequisite for optimal insulin treatment in type 1 and type 2 diabetes.[1]

Fruhstorfer *et al.*[2] measured the quality of three different lancets (Softclix® II and specially made lancets) and the sense of pain with a rating scale of 1–10 in 50 subjects. The reported differences in pain between the different manufactures were not significant; however, the blood volume differed between the lancets. BD Microfine+ gave enough blood volume to measure the blood glucose more often than the other investigated lancets. The average measured pain scored 2.5 on a 10-point scale.[2]

Peled *et al.*[3] compared sense of pain in 24 subjects using an unvalidated scale from 0–5, where 0 corresponded to no pain at all. The aim of the study was to investigate if the blood glucose levels were comparable between different sites – forearm, palm and finger – and to compare pain at different prick test sites. The result showed that the palm scored low regarding pain and compared well in blood glucose levels to the finger. The forearm was only comparable when expecting steady state glycaemic conditions. Of the 24 subjects, 16 estimated the pain as 0 on the five-degree scale and eight estimated the pain as 1.[3]

Fineberg *et al.*[4] investigated pain at different test sites on the arm using SoftSense® compared to the patient's ordinarily used device. A self-created unvalidated six-step questionnaire estimated the subject's sense of pain. Of 354 patients (18–84 years old), 209 (59.9%) experienced no pain, 110 (31.1%) experienced the measured device (SoftSense) as much less painful than the subject's ordinary devices, 23 (5.5%) found it slightly less painful, nine (2.6%) did not experience any difference in pain at all, and three (0.9%) experienced more pain.[4]

Bennion *et al.*[5] investigated whether blood glucose levels, measured on sites other than the finger tip, would increase the frequency of SMBG. This was followed up by HbA_{1c} measurements in a cross-over design. The study showed that 76% preferred to prick themselves with the Freestyle® punction device, because of the many different sites that can be used, but this did

Authors

H Grill-Wikell, RN, Diabetes Nurse Specialist, Research Nurse Specialist
M Annersten, RN, MNsc, Diabetes Nurse Specialist
Öresund Diabetes Team AB, Lund, Sweden
A Frid, MD, PhD, Consultant, Clinic of Endocrinology, University Hospital MAS, Malmö, Sweden

***Correspondence to:** Heidi Grill-Wikell, Öresund Diabetes Team AB, Forskningsbyn IDEON ß2, Scheelevägen 17, S-223 70 Lund, Sweden;
e-mail: heidisgrill@hotmail.com

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not lead to more frequent SMBG and the HbA_{1c} did not improve during the six-month duration of the study.[5]

Pfützner *et al.*[6] evaluated possible differences in the result of blood glucose testing with a SoftSense blood glucose measurement system. SMBG was performed by 66 patients, drawing blood from the forearm and the finger tip. Blood glucose levels in blood obtained from the forearm correlated well with the result achieved from the finger tip. The investigators did, however, see that if the forearm was pricked instead of the finger tip the perceived pain was lower, and more frequent measurements were made.[6]

New devices for SMBG using different sites on the hand or other body parts have been introduced recently, for example, Freestyle and Microlet Vaculance®. It remains to be established which test sites are the most adequate for individual patients. The measured blood glucose values from different test sites in the palm are equivalent according to Peled *et al.*[3] and Jungheim and Koschinsky.[7] Many patients complain of sore finger tips, so this seems to be an important issue.

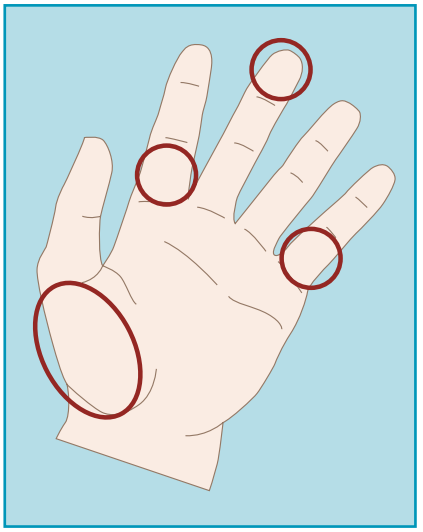

Figure 1. The four different test sites

Figure 2. Freestyle punction device loaded with BD Microfine+ lancet. (© Fredrik von Gerber)

Aim

The aim of this study was to investigate whether or not there are differences regarding pain at different prick test sites in the palm.

Method

A descriptive study to evaluate pain at four different sites in the palm – on the distal phalanx of the third finger, the first phalanx of the fifth finger, the first phalanx of the second finger and on the thumb base – was performed (Figure 1). The study was approved by the Ethics Committee of Lund University. Informed consent was signed by all subjects.

Subjects

Twenty patients (female n=11, male n=9) with type 1 diabetes, with no autonomous or peripheral neuropathy by current criteria.[1]

Exclusion criteria

Subjects with any dysfunction in the hands.

Procedure and device

After washing their hand with soap and water, the subjects pricked themselves in the non-dominant hand with a Freestyle punction device (Figure 2) set at depth 2, which is equivalent to 1.1684±0.254mm, loaded with BD Microfine+ lancets (Figure 2). The order of pricking was randomised. The blue head on the Freestyle punction device was used for the distal phalanx; the transparent head was used on the other test sites, according to the device manual. When using the blue head the depth is about 0.7620mm less than when using the transparent head. The subjects evaluated their sense of pain using a Pain-O-Meter® (Figure 3). The drop of blood was analysed using the Freestyle blood glucose meter, with the original test-strips, to ensure the blood volume was big enough for correct analysis. No further analysis of the blood glucose levels was performed, as this was not the aim of the study.

Pain-O-Meter

The Pain-O-Meter (POM) – shown in Figure 3 – is an instrument which combines a scale that estimates pain intensity (1–10, visual analogue scale [VAS]) with McGill Pain Questionnaire's verbal pain description. The POM was developed in English and has been translated into Swedish. Reliability and validity have been tested in Sweden by Gaston-Johansson.[8,9] The POM contains five parts of which three were used in this study: the VAS, and the two different verbal descriptions.[8] The two excluded measurements describe body parts and whether the pain is consistent or intermit-

tent – which was not relevant for this study.

Statistical analysis

Data are presented as mean ± standard deviation (SD), standard error of mean (SEM), median and range. One-way analysis of variance (ANOVA) was used to compare means.

Result

The pain intensity (POM-VAS) showed no statistical difference between sites (p=0.53) using one-way ANOVA (Table 1). POM-WDS 1 (sensory pain) showed that the pain was described as: shooting (n=36), no pain (n=27), searing (n=8), sore (n=5), pressing (n=2), burning (n=1), and aching (n=1). POM-WDS 2 (affective pain) showed that the pain was experienced as: no pain experience (n=69), nagging (n=10), and agonising (n=1).

Discussion

This study shows that pain level is low when performing SMBG. Some of the subjects were very surprised that they didn't feel any pain at all when pricking themselves in the palm; others had done it before and knew it wouldn't hurt. Previous studies have shown that the palm is a comfortable testing site that equals the forearm in providing virtually painless testing. As the palm is a site with a high blood flow, studies indicate that the palm provides blood glucose results that compare well with those measured in finger samples under all glycaemic conditions, including when blood glucose levels change rapidly.[3,4] In a study by Lee *et al.*[10] blood glucose levels from the finger were compared with the blood glucose levels taken from the forearm of 190 patients (age not specified) measured with a Freestyle blood glucose meter. The study showed a significant difference between finger and forearm if the patient had had a meal one hour earlier but, if the patient waited more than two hours between the meal and the measurement, the difference wasn't significant. The authors recommend measuring the blood glucose levels in the finger tip.[10]

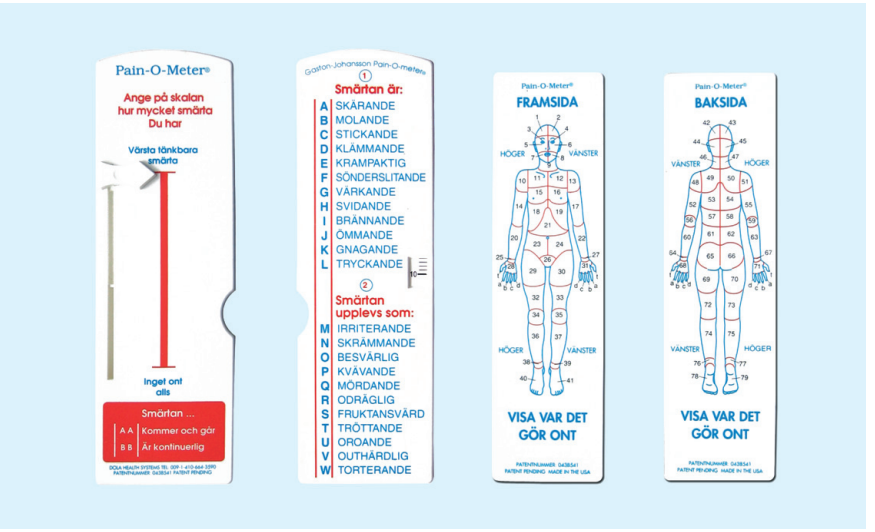

Figure 3. The Pain-O-Meter. (© Fredrik von Gerber)

It may be of interest to study different punction devices and lancets but it can be concluded that the Freestyle punction device combined with BD Microfine+ lancets produced virtually painless skin punctures. This was found in an earlier study as well,[10] also using only one punction device and in the comparable study by Bennion *et al.*[5] using the Freestyle. BD Microfine+ lancets were the lancets which gave enough blood volume according to Fruhstorfer *et al.*[2] so this combination could be recommended for the patient.

Previous testing of the POM has supported its reliability and validity[8,9] in, among others, Swedish patients with myocardial infarction[11] and American patients undergoing bone marrow transplantation.[12] Because of the diversity of the conditions and situations under which the POM has been developed and tested, it has shown a promising potential for being a universal pain assessment tool that could be used in a variety of health care settings with most patient populations. We could not identify any other better advanced, validated instrument to measure pain – a fact that may be of importance when evaluating other studies. All the subjects thought it was a very useful and easy device to use when measuring pain.

Test strips and, to a lesser degree, lancets are expensive. If patients increase the number of measurements, costs for the patient and/or society will increase. However, if the increase leads to improved metabolic control the cost of diabetes-related complications will be less and may well compensate for the extra cost, which is

Test site	SD	Mean	SEM	Median	Range
The distal phalanx of the third finger	0.79	1.44	0.32	0	0–5.8
The first phalanx of the fifth finger	0.67	0.90	0.20	0.3	0–2.8
The first phalanx of the second finger	0.89	0.82	0.18	0.7	0–2.8
The thumb-base	1.18	1.29	0.29	0.75	0–4.5

Table 1. Average of pain intensity on the POM-VAS (0–10), SD and SEM

an important issue regarding the future treatment of patients with diabetes.[13]

To go on with this further we would like to investigate differences in pain measured in the forearm in comparison to the palm, and to see if the HbA_{1c} improved when the frequency of measurements increases. As the Swedish national guidelines state, pain in connection with capillary blood testing can be one of the reasons for avoiding SMBG,[1] and Pfützner *et al.*[6] showed a more frequent measurement when the patient pricked themselves in the forearm instead of the fingertip. On the other hand, Bennion *et al.*[5] showed that less pain in connection with measuring blood glucose levels in the fingertip did not lead to a more frequent measurement. If reducing pain when measuring the blood glucose, the number of measurements can probably be increased if needed in order to guide insulin dosage.[14]

This study shows that the pain in connection with capillary blood testing is very low. There are no significant differences in the pain experienced at different sites in the palm and finger tip, and hereby the palm offers an alternative sampling site that compares well with the finger, regarding blood glucose level at all times. This is also true when rapid changes are anticipated – for example, in hypoglycaemia, immediately after a meal or when exercising.

Therefore, we recommend these alternative test sites in the palm to patients with diabetes who would like to avoid sore or calloused finger tips.

Product name	Company
Freestyle punction device	Abbott
BD Microfine+ Lancets	BD
Softclix II	Roche
SoftSense	Abbott
Microlet Vaculance	Bayer

Overview of the products in the article

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Conflict of interest statement

None.

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