Diabetic Patient Preference Using Alternative Site Testing (AST) Versus Fingertip Site for Blood Sugar Monitoring

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Introduction
Diabetes Mellitus is a public health crisis that affects nearly one in ten adults in the United States (Cowie et al., 2010). Studies find there are a multitude of barriers (cost of supplies, fear of pain and needles, inconvenience) that prevent individuals with diabetes from consistently monitoring their blood sugar (Ong et al., 2014). This presentation will review the literature on the use of alternate site testing (AST) versus fingertip site testing. AST utilizes drawing blood from alternate sites such as the earlobe, forearm, or palm to measure blood glucose. This presentation will review the level of pain, accuracy, and ease of obtaining a blood sample at alternate sites compared to the fingertip site.

Research findings, benefits and drawbacks of AST, and recommendations for future research will be presented.

The Earlobe as an Alternate Testing Site
- The earlobe has less pain receptors than the fingertip, and it has comparable vascularity (Anzalone, 2008).
- Level of pain at the earlobe was significantly lower than the finger (Chan et al., 2016; Toledo & Taylor, 2004).
- All studies supported the use of earlobe site on account of accuracy compared to the fingertip.
- Basbakkal, the blood sample (Toledo & Taylor, 2004) attempt from 74% of participants, compared to a success rate of 88% from the fingertip site.
- In some studies, blood samples were collected from the forearm site using a specially designed device (see Figure 1).
- The forearm site was found to be just as accurate as the fingertip site, even during unsteady glycomic states (Lock et al., 2002; Tieszen & New, 2003).
- 93% of participants found the forearm site to be easier for obtaining blood than the fingertip site (Tieszen & New, 2003).
- Unique Participant Populations
- 61% of pediatric patients found the forearm site was painless, 19% said it was slightly less painful, 14% said it was similar in pain level, and 6% said it was slightly more painful (Greenhalgh et al., 2004).
- A study conducted by Clarke et al. (2005) found that pregnant women with gestational diabetes preferred the forearm site to the fingertip site.

The Palm as an Alternate Site Testing Site

- One study found the palm site to be significantly less painful than the fingertip site (Pavithran et al., 2020).
- Two studies found the level of pain using the palm site to be insignificantly different compared to the fingertip site (Grill-Wikell et al., 2005; Knapp et al., 2009).
- Participants preferred using the palm site although there was no statistically significant difference in pain level (Ito et al., 2010).
- The palm site was found to be just as accurate as the fingertip site during all glycomic states (Pavithran et al., 2020).
- One study found that participants preferred to use the palm as an alternate site even though they had difficulty obtaining a blood sample (Ito et al., 2010).

Benefits & Drawbacks
- Earlobe and forearm sites were found to be less painful than the fingertip site, while the palm site was just as uncomfortable as the fingertip site (Chan et al., 2016; Clarke et al., 2005; Greenhalgh et al., 2004; Grill-Wikell et al., 2005; Knapp et al., 2009; Tieszen & New, 2003; Toledo & Taylor, 2004).
- All of the alternate sites were found to be clinically accurate compared to the fingertip site during steady glycomic states.
- The earlobe and forearm sites were less accurate during unsteady glycomic states using standard lancet and glucometer equipment, while the palm was accurate during all glycomic states (Bastakkal et al. 2007; Chan et al., 2016; Lock et al., 2002; Tieszen & New, 2003; Toledo & Taylor, 2004).
- The palm site was mentioned as being most difficult to obtain a blood sample from, compared to the fingertip site (Ito et al., 2010).

Limitations
- Many of the studies had small sample sizes and quasi-experimental designs (Anzalone, 2008; Ito et al., 2010; Lock et al., 2002; Grill-Wikell et al., 2005; Knapp et al., 2009; Tieszen & New, 2003; Toledo & Taylor, 2004).
- Different patient populations (acutely or critically ill) and ethnic populations (People of Color and Hispanic) were underrepresented in the literature (Anzalone, 2008).
- The earlobe site was not tested to reflect the accuracy of blood glucose readings during unstable glycomic states (Anzalone, 2008; Chan et al. 2016; Toledo & Taylor, 2004).

Recommendations for Future Research
- Use an experimental design, a larger sample size, and random sampling so results can be generalized to a broader population.
- Determine the accuracy of earlobe measurements compared to fingertip measurements taken during unsteady glycomic states.
- Compare glucose readings of alternate sites to fingertip and venous measurements to create a specific range for alternate sites.
- Determine potential adverse effects (trauma, soreness, tingling, etc.) of repeated testing on alternate sites.
- Determine patient preference when AST is used in an outpatient setting.
- Determine potential effect of AST on glycomic control.
- Research aimed at educating clinicians and patients how to perform alternate site testing when the fingertip site is contraindicated or refused.

References