Clinical Ops

The of Value of Width Projection Accuracy Relative to Vein Depth
Real Depth Accuracy Value (RDAV)

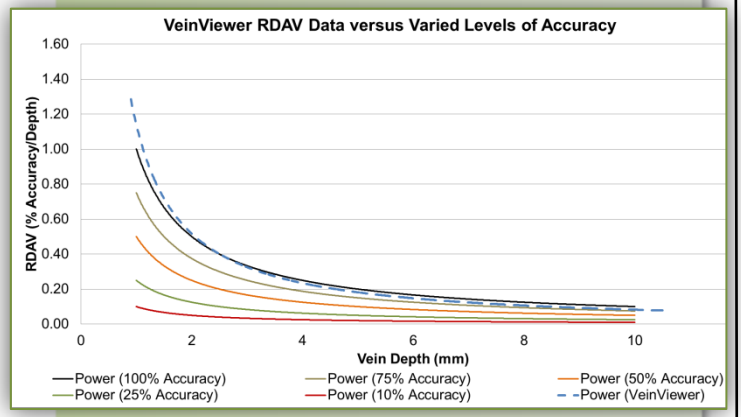
The Facts:

Christie Medical Holdings has developed a method to analyze the vein width accuracy of the VeinViewer projected image based on depth of the vein.

Christie's metric called Real Depth Accuracy Value, *or RDAV*, factors in the depth of the vein when analyzing the projected vein width accuracy.

Christie analyzed the 3000 data points used as the basis for its TrueView vein width projection accuracy claim and incorporated the depths of the veins to determine the RDAV scores for each of these points.

When plotted against theoretical levels of accuracy, VeinViewer demonstrated high fidelity to the 100% accuracy curve.



Conclusion

VeinViewer can be trusted to project a highly accurate image of veins that are up to 10.0mm deep.

IN SUMMARY:

Christie Medical Holdings (Christie) is the trusted leader in near-infrared vascular imaging systems. Its line of products, VeinViewer® Vision, VeinViewer^{XTND} and VeinViewer Flex, are sought by medical professionals around the globe. This technology leadership is demonstrated through VeinViewer's proven 3,000 data point TrueView and MaxDepth study results. When compared against ultrasound, the vascular access industry gold standard, VeinViewer images have been shown to be accurate within +/- 0.5mm across all vein widths and +/- 0.06mm for veins most commonly accessed for peripheral intravenous lines, those that are 3.0 – 7.0mm wide throughout depth, up to 10mm deep. VeinViewer is also proven to see blood patterns up to 15mm deep.

To further this reputation for accuracy, Christie has developed a method to analyze vein width accuracy of its projected image based on depth of the vein. This paper will discuss how the Real Depth Accuracy Value (RDAV) was created and why its application in clinical peripheral vascular access is important.

The concept of TrueView, though powerful, only speaks to one way of relating accuracy of the projected VeinViewer image: *vein width*. Due to the inherent nature of light scattering, Christie felt it was important to understand how the accuracy of its projected images changes at various depths. With this in mind, Christie created a metric that enables the relation of projected vein width accuracy at a certain depth:

equation 1:

$$RDAV = \frac{[VeinViewer\ Width(mm)/Ultrasound\ Width\ (mm)]}{Ultrasound\ Depth\ of\ the\ Center\ of\ the\ Vein\ (mm)}$$

OR

$$RDAV = \frac{\%\ \boldsymbol{Accuracy}}{\boldsymbol{Depth}}$$

The top part of the equation represents the image accuracy as a percent. For instance, if the VeinViewer projected vein width is 1.0mm and the measured ultrasound width for the same vein is 1.0mm, then there is perfect agreement, and the accuracy is 100%. Expressed without the percentage, the number is 1.0.

When the accuracy measurement is applied to a vein whose center is approximately 1.0mm deep (as measured by ultrasound), the equation looks like this:

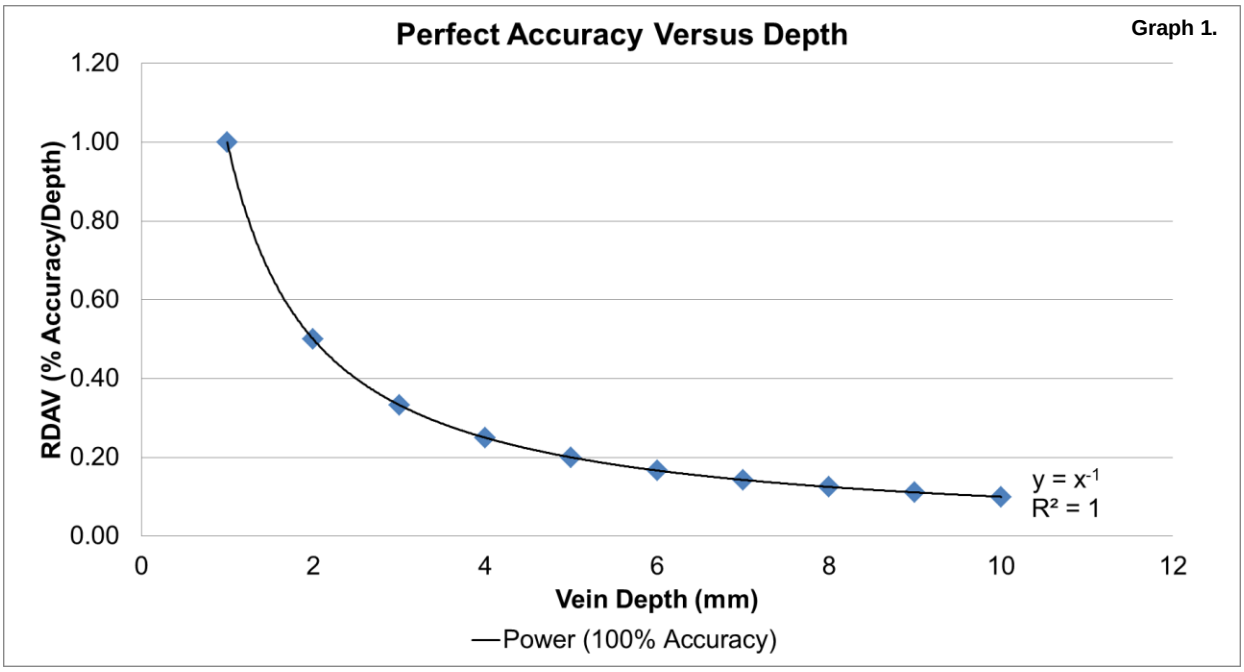
$$\text{equation 2:} \quad \boldsymbol{RDAV} = \frac{\mathbf{1.0}\ (\boldsymbol{accuracy})}{\mathbf{1.0}\ \boldsymbol{mm}\ (\boldsymbol{depth})} = \mathbf{1.0}$$

Therefore, for a vein whose center lies at 1.0 mm beneath the surface of the skin and where the accuracy of the VeinViewer image is perfect (1.0), the RDAV score is 1.0.

Similarly, the RDAV score for a vein whose center lies 2.0mm beneath the surface of the skin and where the accuracy of the VeinViewer image is perfect would be 0.5.

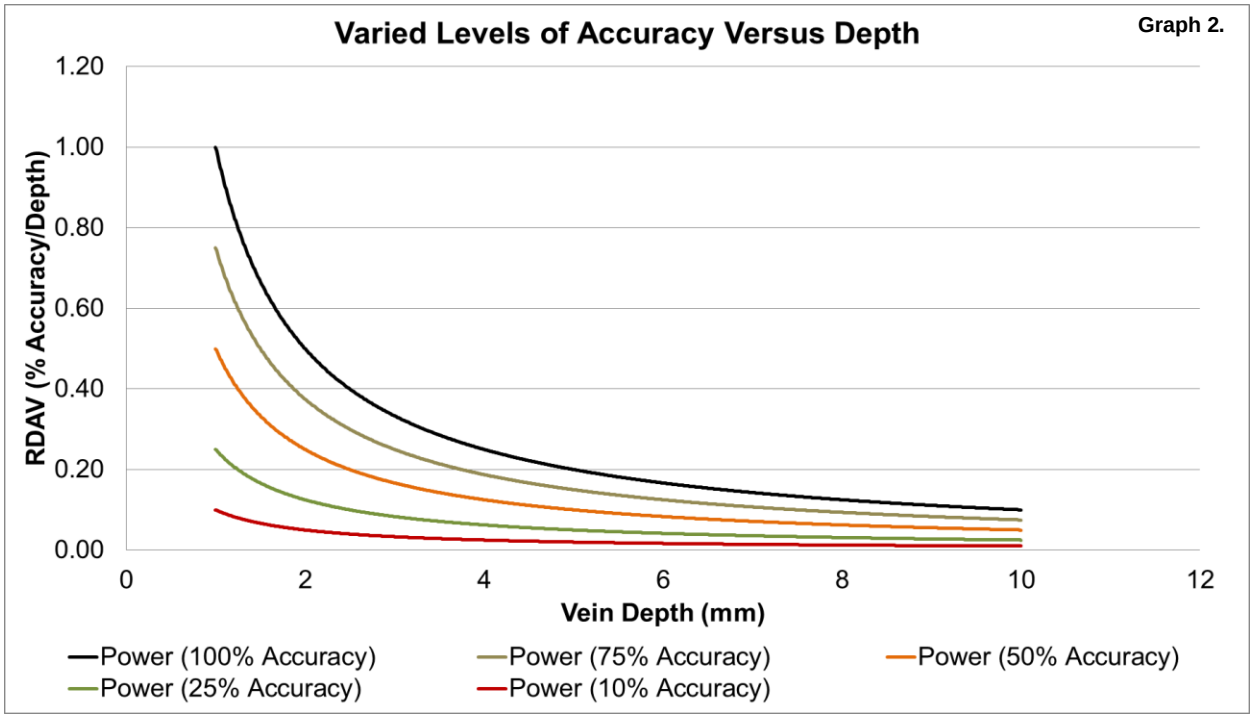
$$\text{equation 3:} \quad \boldsymbol{RDAV} = \frac{\mathbf{1.0}\ (\boldsymbol{accuracy})}{\mathbf{2.0}\ \boldsymbol{mm}\ (\boldsymbol{depth})} = \mathbf{0.5}$$

As increasing depths are used in the above equation, it follows that the RDAV score decreases by smaller and smaller amounts. These RDAV scores when plotted against the depths provide a line that demonstrates 100% RDAV perfection at certain depths (graph 1) and provides a standard against which we can compare real world data.

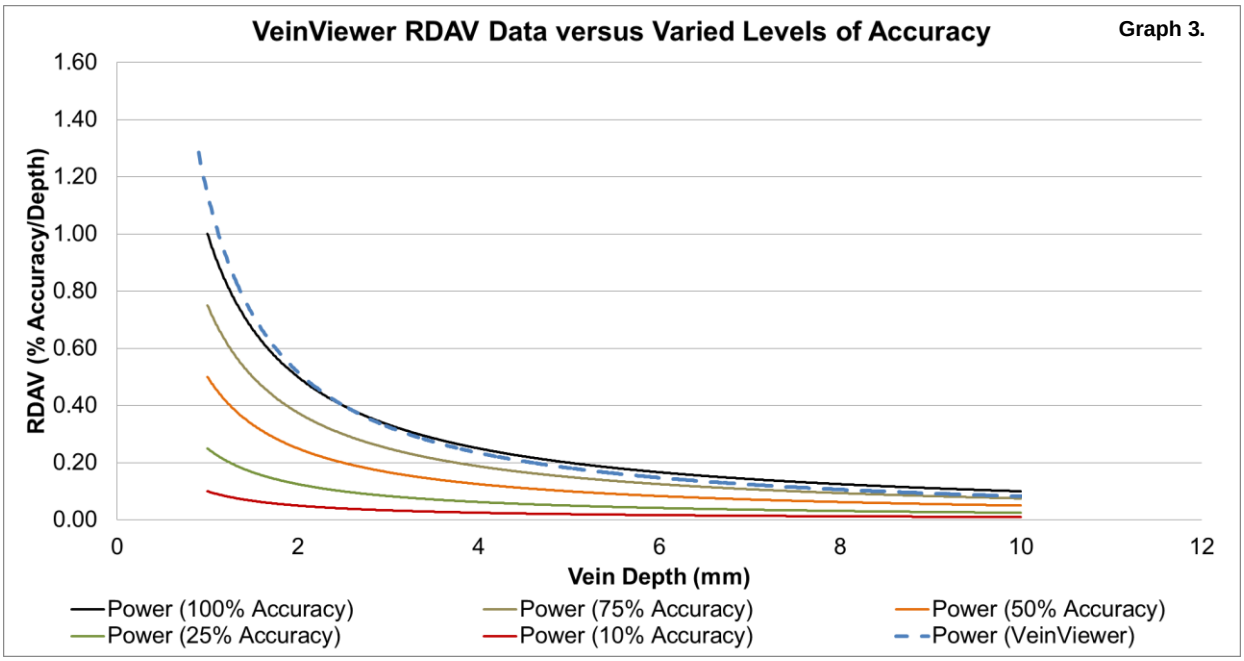


Graph 1.

Just as perfect RDAV can be mapped, lesser amounts of perfection can be mapped, such as 0.75 or 0.5 (i.e., 75% or 50%, respectively). Christie used this graph as a ruler by which real-world data was compared.



Working with over 3,000 data points that were used to form the basis of VeinViewer TrueView capabilities described earlier, Christie determined the RDAV for each individual point. RDAV data were plotted and compared to the various levels of potential perfection (graph 3).



In the above graph, the alignment of VeinViewer RDAV values to the theoretical 100% RDAV accuracy line is near-perfect. This demonstrates that the accuracy of the VeinViewer projected vein width image is closely maintained to perfection even as the depth of the vein increases.

Being that the accuracy of any device that assists a clinician with vascular access is important the clinician must be able to trust the image that they are seeing. The ability to trust a medical device is also necessary for integration into clinical protocols. For instance, the selection of an appropriately sized needle or catheter is crucial as those that are too large for the vessel may cause damage to the wall of the vein or impede blood flow and potentially lead to thrombosis.

The Real Depth Accuracy Value (RDAV) developed here gives the clinician a metric with which to evaluate the accuracy of a vein image projection. Christie's extensive data collection and analysis proves the reliability of the VeinViewer image. With over 3,000 data points, VeinViewer has demonstrated near-perfect image accuracy throughout peripheral venous depths up to 10mm.