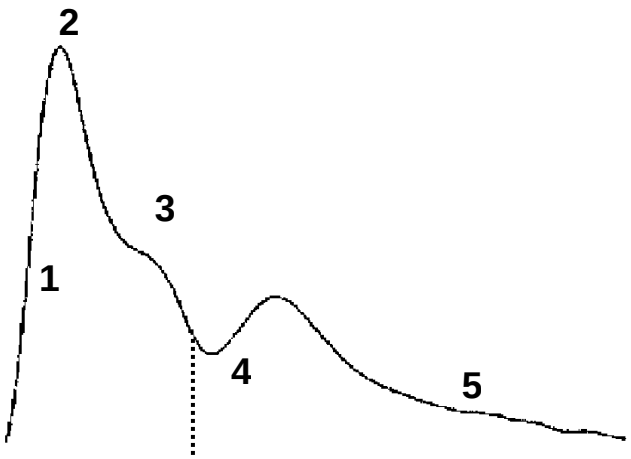
Technical Note No: 14

Assuring Quality of Pulse Wave Analysis Measurements

Features of the Radial Artery Pressure Waveform that Identify a Good Quality Waveform

Certain features of the radial artery pressure waveform may vary in position, but overall waveform shape will remain the same. For example, the effects of aging are seen in the waveform of a middle-aged person as an increase in amplitude of the second systolic shoulder and a decrease in amplitude of the pressure waveform during diastole. The discussion and illustration below provide guidance for review of the radial waveform to assure good data quality.



1. A sharp, nearly linear initial upstroke of the pressure waveform for at least 80 msec. "Bumps" or noise in the upstroke will be incorrectly interpreted by the analysis software as the end of the initial pressure wave.
2. A peak (in some cases an inflection point or shoulder) at between 80 and 150 msec.
3. A late systolic shoulder between the first peak and incisura. The location of this shoulder will differ depending on the age and disease. In older persons this shoulder may, in fact, be a second peak. In very young people, this may not be detectable.
4. The incisura, marked on the sample waveform at left by a vertical dotted line, will be located after the late systolic shoulder and immediately before an inflection of the radial pressure waveform.
5. The pressure through diastole should smoothly decrease to approximately the same pressure as at the beginning of the waveform. It should nowhere be flat.

Waveform Criteria

The following criteria should be applied to waveform data available on the SphygmoCor Clinical and Detailed Report Screens as a means assuring data quality. If any of these criteria are not met (regardless of the system's quality control parameters), the recording should be repeated and strong consideration given to not retaining the data.

T1 (Detailed Screen): 80 ms < T1 < 150 ms

Minimum Average Pulse Height (Clinical Screen): 100 units

Maximum Pulse Height Variation (Clinical Screen): 5%

Maximum Diastolic Variation (Clinical Screen): 5%

Minimum Quality Index (Clinical Screen): 80

Augmentation Index (Clinical Screen): <50%

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Examples of typical, good quality radial waveforms

The detailed screen shows the 10 second of recorded and analyzed waveforms (see Figure 2 below). These can be examined to assess overall consistency of the waveforms. The series of waveforms should have consistent peaks and troughs, and the contour of the waveform, in particular the peak pressure and shoulder, should be identical.

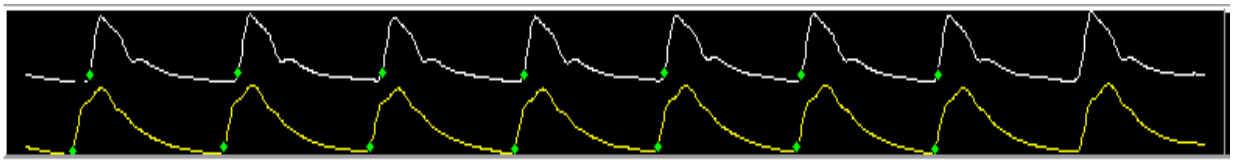
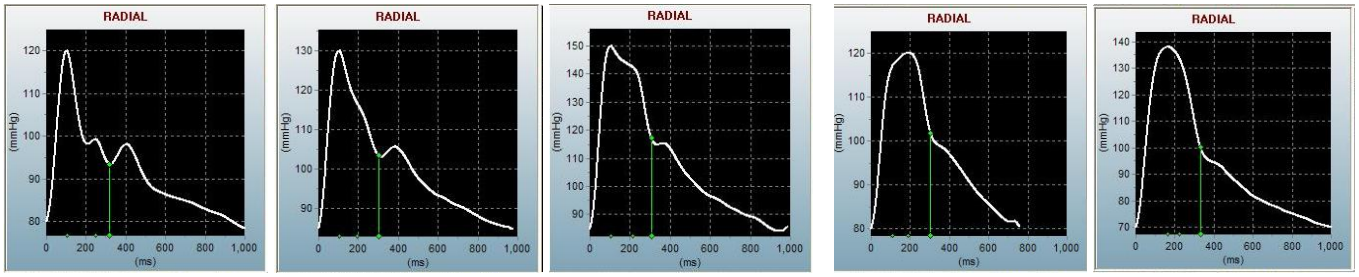


Figure 2. Captured raw peripheral (top), displayed with the derived aortic waveform (bottom).

Radial waveforms of people with different vascular ages (note that chronological age may differ substantially from vascular age):



20 year old | 30 year old | 40 year old | 50 year old | 70 year old

Examples of poor raw waveform data:

The captured waveforms and their respective waveform overlay show some common examples of poor quality waveforms. When the raw waveform signal appears as in the first two examples below, it is due to the tonometer not being directly on top of the radial artery and the tonometer needs to be readjusted. Variation in the peaks and troughs of the waveforms, as shown in the third example, indicates that a change in pressure was applied to the tonometer and the operator should aim to hold the tonometer more steady (However, this may also represent an unavoidable respiratory artifact). In addition, the diastolic portion of the waveform is flat, indicating that the hold-down pressure is too high and the artery is being occluded. In each instance the measurements should be repeated.