

Single Event Analysis

PVC Event

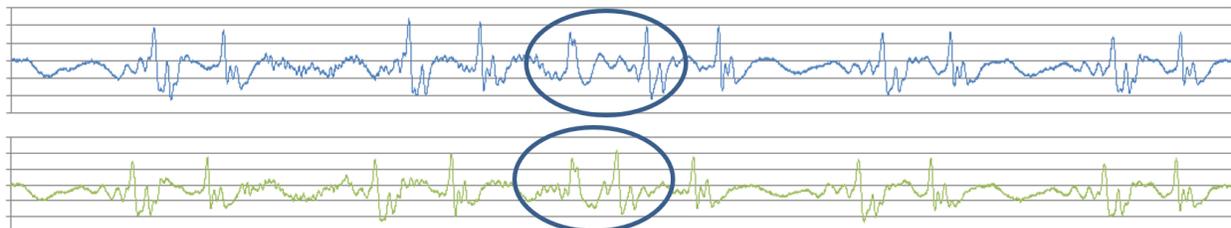
Prior to the current invention, studies performed at the Cleveland Clinic and other locations describe a premature ventricular contraction (PVC) as; “A premature ventricular contraction (PVC) is a too-early heartbeat that originates in the ventricles and disrupts the heart’s normal rhythm. The pattern is a normal beat, an extra beat (the PVC), a slight pause, then a stronger-than-normal beat.” This understanding was arrived at from studying ECG data which is derived from the integral ingredient for the creation of the heart-beat, the beat stimulus. Marking and determining the intervals of the P, Q, R, S, T and U intervals and their separations led to this description.

With the new tools now available it can be seen by the analysis of the actual produced force, and not that of the electrical creation that induces said movement/force; that the event is not exactly as described. The close analysis of the Force signal and its respective timing shows something slightly different.

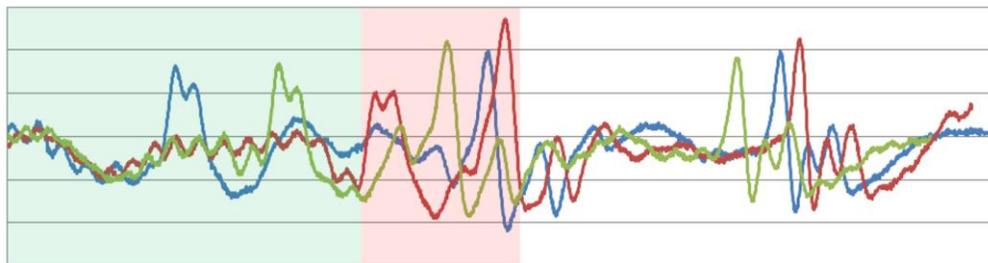
Shown here circled is a PVC event that occurs just before the normal systolic peak force. This particular event matches the description above very well. There is indeed an extra beat, and then a following compensatory pause (called pause above) and then a series of major acceleration forces equated to the “next beat extra force”.



The interesting difference afforded by the analysis of the actual force compared to that of the ECG are the following examples of the “too-early” PVC event. In these two cases the “too-early” event is way too early. Too-early to create the compensatory pause. It is easily seen that in the blue data trace the PVC event is very early, and the event in the green data trace is very nearly the same as that shown above in the red data, which had the “pause”. Note that in these two events the “pause” following the afflicted heart-beat is missing. Dissimilar certainly but not missing. In both instances the timing of the heart-beat is virtually identical to those that preceded the errant beat. Whereas the large pause in the red data trace above is fairly obvious, as is the subsequent widely variant acceleration forces.



Interestingly, further analysis provided by the more accurate detail of the force study, it was discovered that **when** the PVC acceleration force is realized is the major difference.



The additional analysis capability of the new method revealed that the only time the errant acceleration (PVC Event) created a compensatory pause, was when it took place within the Ventricle Stiffening interval (red shaded area) identified in the new method. If the errant acceleration takes place at any time (green shaded area) before that interval in either the Ventricle Filling interval or the Ventricles Filled intervals there will be no compensatory pause. Now then it is true that before this method the accuracy of markers and interval identification was not with the current accuracy of milliseconds, so this observation could easily be missed with accuracy only in the hundreds of milliseconds.