The cause of multiple substorm onsets is studied with THEMIS observations in a time period of 0 $>$ SYM-$H$ $-$6 nT on 11 March 2009. During that period, seven consecutive bursts of Pi2 pulsations occurred simultaneously at the ground stations from high to low latitudes. Except for the last burst accompanied by a sharp increase in THEMIS-AE, the first pair appeared in two discrete substorm cycles of growth and then decline in Kyoto-AL but the second pair recurred in growth and the third pair in decline within one distinct substorm cycle. The ground-based and geostationary orbit magnetometers sensed magnetic perturbations consistent with the one affected by the formation of the substorm current wedge. THEMIS probes at -10 Re $>$XGSM$>$ -16 Re observed magnetic dipolarizations, flow burst activations and modulated energetic particle fluxes at ground Pi2 onsets. The mapping of ground Pi2 onset timing to the solar wind observation just in front of Earth’s magnetopause shows that in addition to five bursts associated with enhanced solar wind dynamic pressures, one pair appear under an IMF variation cycle of north-to-south and then north. For that pair, wavelet transformations of $H$ and $D$ components at high latitudes show first higher frequency and then lower one bearing the spectral characteristics of double-onset substorm triggered by northward turning. Hence, it is suggested that the two-neutral-point model can explain multiple substorm onsets during a non-storm period.