through EGG: the rate at which the glottis closes, the rate at which it opens, and the relative duration of the closed and open phases. Opening and closing rates are seen in the slope of the ascending/descending portions of the signal. Open/closed phase duration is expressed through the *closed quotient* (CQ), which shows the percent of time the glottis is closed during each cycle (the open quotient is the reciprocal of this number).

It usually is easy to locate the moment of glottal closure with EGG by the slight change in slope that often is seen near the top of the signal. Finding the spot where the glottis opens is bit trickier. Opening occurs at some point while the EGG trace is descending. But the only way to know with 100% certainty that you have located this event is to view the vocal folds simultaneously in a laryngoscope. Determining the moment of opening is extremely important, for without that information, it is impossible to measure closed quotient accurately. Fortunately, clues are provided that make laryngeal visualization unnecessary. For less experienced users of the technology, most programs estimate the moment of glottal opening through a default setting that is based on a typical opening point (35% above the bottom of the measurement scale in VoceVista). Using this default setting reduces accuracy, but the measure still is sufficient to show changes within a single subject. As such, it is useful for identifying registration events and for monitoring phonation for insufficient or excess glottal closure that leads to breathy and/or pressed sounds (Figure 5-30A). An alternate, and often more accurate method, examines the contour of the opening phase of the signal. Often, there will be a small bend that looks a bit like a knee; there is a good chance this represents the actual moment of opening (Figure 5-30B).

Miller (2008) identifies another potentially important element that can be evident within the EGG signal: the *effective* closed quotient. Traditional CQ measurements are designed to show the absolute ratio of time the glottis is physically closed versus open; effective CQ shows the acoustic impact of the opening glottis. As the glottis widens, a point is reached where the opening is large enough to alter the acoustic properties of the vocal tract. At this point, the standing wave that results from good resonance is damped. We can see this event by coordinating the EGG and audio signals (Figure 5-30C). Note the fourth major peak in the audio waveform, which is followed by an abrupt attenuation of energy. Effective CQ is derived by aligning this peak/attenuation event with the EGG signal. Because effective CQ is based on an open glottal configuration, it can be significantly larger than traditional CQ measures.

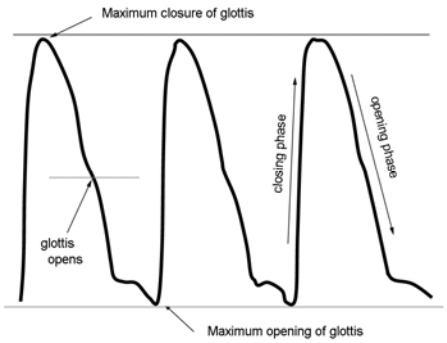

Figure 5-29: Elements of the EGG signal

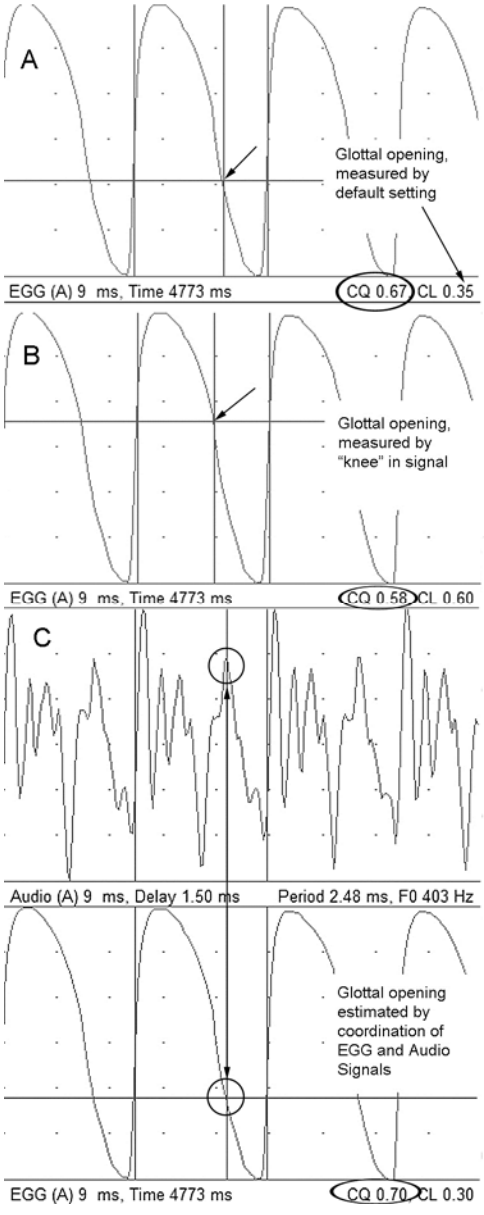

Figure 5-30: Opening of glottis: three ways to measure the closed quotient