Flow and Vacuum Settings 1: Distal Followability

Moreover, we will determine when flow and vacuum are relevant parameters at various intraoperative stages. **Aspiration flow rate** (cc/min) determines how strongly fluid and fragments are attracted toward the unoccluded aspiration port (**distal followability**). Once a fragment occludes the aspiration port, vacuum (mm Hg) determines how strongly it is held to the aspiration port. **Therefore, the degree of aspiration port occlusion is a vital clinical determinant of which parameters are pertinent at a given moment in surgery**.

For example, in Figure 2-4, let's assume a flow pump machine with a flow rate of 18 cc/min and a vacuum preset of 100 mm Hg. If the quadrant were entirely free-floating, this low flow rate would probably be sufficient to attract it to the tip. However, if the quadrant were not readily moving toward the tip (ie, because of residual nuclear or epinuclear adhesions), then an appropriate adjustment would be to increase flow rate in order to produce a stronger current and therefore a stronger attraction (a surgeon using a vacuum pump could at this point increase commanded vacuum in the drainage cassette, which would increase flow through the unoccluded tip as in Figure 1-28). Alternatively, the tip could be moved closer to the quadrant, recalling that the current is stronger closer to the tip (see Figure 2-3). Note that even though the vacuum limit preset is 100 mm Hg, the actual vacuum just inside the tip is minimal because of the negligible resistance to flow from the large bore phaco needle (see Figures 1-28 and 1-41). Therefore, increasing the vacuum limit preset level on a flow pump in this scenario would not enhance attraction; it would simply change the vacuum preset reading on the panel (green bar) without affecting the fluidics. Recall that a flow pump's vacuum preset limit only determines the level to which actual aspiration line vacuum will rise given sufficient resistance to flow, usually with occlusion of the aspiration port (see Figure 1-11). If Figure 2-4 represented a vacuum pump instead of a flow pump, then increasing the commanded vacuum level would increase attraction of the fragment to the tip by the corresponding increase in flow rate (recall Figure 1-28; recall also the difference between commanded vacuum with a vacuum pump and vacuum limit with a flow pump defined in Figures 1-8 and 1-25). Recall that **bottle height** must be increased to maintain anterior chamber depth and pressure if aspiration outflow is increased.

In Figure 2-5, ultrasound energy (pedal position 3) has been used to embed the tip into the nuclear fragment such that approximately two thirds of the aspiration port is occluded. Flow still