where the dimensionless parameter $Cl_{rN} = Cl_r K_r/(k_p A)$ is a measure of the magnitude of the removal rate from the receptor phase (Cl_r) relative to transport through the membrane ($k_p A$), and $V_{rN} = V_r K_r / V_m K_m$ is the dimensionless receptor volume defined as the ratio of the amount of drug in the receptor phase and membrane ($C_r V_r / C_m V_m$), assuming equilibrium exists between phases.

Figure 2.7 shows the effect of receptor volume (as defined by V_{rN}) and clearance of solution from the receptor phase (as defined by Cl_{rN}) on the $J_s(t)$–time profile.

The steady-state approximation of Equation (2.31) is:

$$Q(t) \approx AJ_{ss}\left(t - \text{lag}\right) \tag{2.33}$$

where:

$$J_{ss} = k_p C_v \frac{Cl_r}{Cl_r + \left(k_p A / K_r\right)} = \frac{k_p C_v}{1 + \left(1 / Cl_{rN}\right)} \tag{2.34}$$

and:

$$\text{lag} = \frac{t_d}{6}\left[1 + \frac{2Cl_{rN} - 6V_{rN}}{Cl_{rN}\left(Cl_{rN} + 1\right)}\right] \tag{2.35}$$

We note that if Equation (2.29) is substituted into Equation (2.28), the expression for J_{ss} is identical to Equation (2.34). We also note that when $Cl_r \to \infty$ (infinite sink), J_{ss} and lag reduce to Equations (2.4) and (2.12), respectively.

The corresponding solution for the receptor/epidermal concentration with the noted boundary conditions is:

$$\hat{C}_r(s) = \frac{k_p A C_v}{s} \frac{\sqrt{st_d}}{\left(V_r s + Cl_r\right)\left\{\sinh\sqrt{st_d} + \left[\sqrt{st_d} / \left(st_d V_{rN} + Cl_{rN}\right)\right]\cosh\sqrt{st_d}\right\}} \tag{2.36}$$

At long times $t \to \infty$, C_r is defined by Equation (2.29).

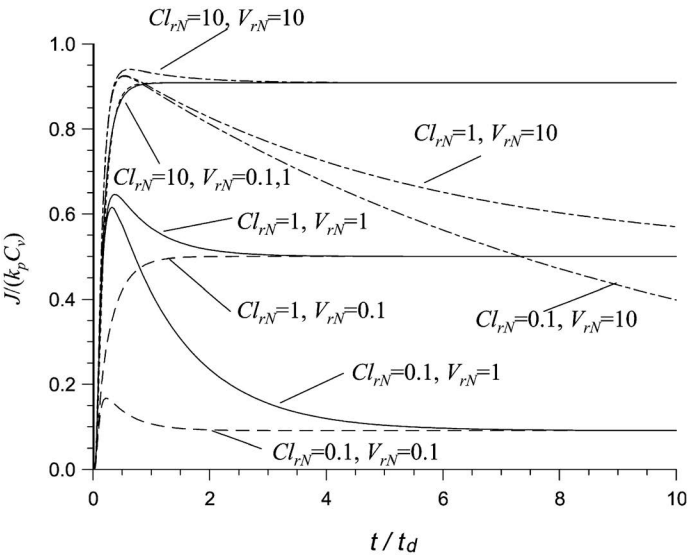

FIGURE 2.7 Normalized flux ($J/k_p C_v$) versus normalized time (t/t_d) for a finite receptor volume and limited clearance [Equation (2.32)], $Cl_{rN} = Cl_r K_r / k_p A$, $V_{rN} = V_r K_R / V_m K_m$.