The apparent barrier height \( \phi(\text{ap}) \), that is, the rate of change of the logarithm of the conductance with tip-sample separation in a scanning tunneling microscope (STM), has been measured for Ni, Pt, and Au single crystal surfaces. The results show that \( \phi(\text{ap}) \) is constant until point contact is reached rather than decreasing at small tunneling gap distances, as previously reported. The findings for \( \phi(\text{ap}) \) can be accounted for theoretically by including the relaxations of the tip-surface junction in an STM due to the strong adhesive forces at close proximity. These relaxation effects are shown also to be generally relevant under imaging conditions at metal surfaces.