Understanding the effects of tool wear is critical to predicting tool life, the point at which tool performance, in terms of power requirement, dimensional error, surface finish, burring, or chatter, is no longer acceptable. To achieve the long cuts that are required for wear testing while maintaining a clear view of the basic process geometry effects, ideal straight-edged orthogonal conditions are realized in a bar-turning arrangement by employing a specially designed two-tool setup. The data show that increasing edge radius tends to increase wear rate, especially at the initial cut-in wear phase. The data also show that when the uncut chip thickness is less than or equal to the edge radius, forces actually decrease substantially with flank wear until most of the edge radius has been worn away. At that point the forces begin to increase with flank wear in a power-law fashion. This decreasing-then-increasing trend is a result of the parasitic (non chip removing) wearland force increasing more slowly than the chip-removal force is decreasing. The decrease in chip-removal force with an increase in flank wear results from the blunt edge being effectively sharpened as it is removed by the growing wear land. An empirical model structure is formulated, guided by specific elements of the data, to well represent the force trends with respect to wear and edge radius and to assist in their interpretation. The edge-sharpening concept is further supported by a special experiment in which the edge sharpening effect is studied in the absence of wear land.