The main objective of this study was to investigate the extent to which hearing impairment influences the duration of sentence processing. An eye-tracking paradigm is introduced that provides an online measure of how hearing impairment prolongs processing of linguistically complex sentences; this measure uses eye fixations recorded while the participant listens to a sentence. Eye fixations toward a target picture (which matches the aurally presented sentence) were measured in the presence of a competitor picture. Based on the recorded eye fixations, the single target detection amplitude, which reflects the tendency of the participant to fixate the target picture, was used as a metric to estimate the duration of sentence processing. The single target detection amplitude was calculated for sentence structures with different levels of linguistic complexity and for different listening conditions: in quiet and in two different noise conditions. Participants with hearing impairment spent more time processing sentences, even at high levels of speech intelligibility. In addition, the relationship between the proposed online measure and listener-specific factors, such as hearing aid use and cognitive abilities, was investigated. Longer processing durations were measured for participants with hearing impairment who were not accustomed to using a hearing aid. Moreover, significant correlations were found between sentence processing duration and individual cognitive abilities (such as working memory capacity or susceptibility to interference). These findings are discussed with respect to audiological applications.