For normal-hearing listeners, auditory pure-tone thresholds in quiet often show quasi periodic fluctuations when measured with a high frequency resolution, referred to as threshold fine structure. Threshold fine structure is dependent on the stimulus duration, with smaller fluctuations for short than for long signals. The present study demonstrates how this effect can be captured by a nonlinear and active model of the cochlear in combination with a temporal integration stage. Since this cochlear model also accounts for fine structure and connected level dependent effects, it is superior to filter-based approaches and hence allows the investigation of the contributions of cochlear- and retro-cochlear processing on behavioural data, including stimulus-duration dependent effects of threshold fine structure.