The direct observation of molecular dynamics initiated by x-rays has been hindered to date by the lack of bright femtosecond sources of short-wavelength light. We used soft x-ray beams generated by high-harmonic upconversion of a femtosecond laser to photoionize a nitrogen molecule, creating highly excited molecular cations. A strong infrared pulse was then used to probe the ultrafast electronic and nuclear dynamics as the molecule exploded. We found that substantial fragmentation occurs through an electron-shakeup process, in which a second electron is simultaneously excited during the soft x-ray photoionization process. During fragmentation, the molecular potential seen by the electron changes rapidly from nearly spherically symmetric to a two-center molecular potential. Our approach can capture in real time and with angstrom resolution the influence of ionizing radiation on a range of molecular systems, probing dynamics that are inaccessible with the use of other techniques.