Density relaxation refers to the phenomenon in which granular solids experience an increase in bulk density due to the application of external, time-dependent forces. To model this process, discrete element simulations are carried out using dissipative soft-sphere spheres housed within a laterally periodic box. Tapping is achieved by prescribing a half sine wave impulse to the floor followed by a relaxation interval to allow the system to come to rest. The solids fraction evolves non-monotonically with floor acceleration $\Gamma$ – reaching ~95% of the HCP theoretical maximum - with a gradual reduction to a loose packing as $\Gamma$ increases beyond the peak point. The evolution to high bulk density is accompanied by the appearance of an order within the microstructure. Animations of the simulation data reveal the propagation of a wave initiated from the floor that causes local rearrangements of the particles, which ultimately leading to the development of a dense packing after many hundreds of taps.