The performance of a camless internal combustion engine connected to an adaptive artificial neural network (ANN) based feedback controller is investigated. Input-output data at a speed S = 1500 RPM was generated and used to train an ANN model for the engine. The inputs are the intake valve lift (IVL) and closing timing (IVC) whereas the output is the cylinder air charge (CAC). Based on the thermodynamics and ANN engine models an adaptive feedback controller is designed. The controller consists of a feedforward controller, cylinder air charge estimator, and on-line ANN parameter estimator. The feedforward controller provides IVL and IVC that satisfy the desired CAC (or driver's torque demand) and is the inverse of the engine ANN model. The on-line ANN uses the error between the cylinder air charge measurement from the cylinder air charge estimator and its predicted value from the ANN to update the network's parameters recursively. The feedforward controller is thus adapted since its operation depends on the ANN model. The adaptation scheme improves the ANN prediction accuracy when the engine parts degrade, speed changes and in the presence of modeling errors. Consequently, the engine controller keeps good CAC tracking performance over the long time horizon. The camless engine controller capability is demonstrated through computer simulation.