We review and extend the previous work where a model was introduced for Hopfield-type neural networks, which allows for the existence of heteroclinic dynamics between steady patterns. This dynamics is a mathematical model of periodic or aperiodic switching between stored information items in the brain, in particular, in the context of sequential memory or cognitive tasks as observed in experiments. The basic question addressed in this work is whether, given a sequence of steady patterns, it is possible by applying classical learning rules to build a matrix of connections between neurons in the network, such that a heteroclinic dynamics links these patterns. It has been shown previously that the answer is positive in the case where the sequence is a so-called simple consecutive cycle. We show that on the contrary the answer is negative for a non-simple cycle: heteroclinic dynamics does still exist; however, it cannot follow the sequence of patterns from which the connectivity matrix was derived.