Finding the longest common subsequence of a given set of input strings is a relevant problem arising in various practical settings. One of these problems is the so-called longest arc-preserving common subsequence problem. This NP-hard combinatorial optimization problem was introduced for the comparison of arc-annotated Ribonucleic acid (RNA) sequences. In this work we present an integer linear programming (ILP) formulation of the problem. As even in the context of rather small problem instances the application of a general purpose ILP solver is not viable due to the size of the model, we study alternative ways based on model reduction in order to take profit from this ILP model. First, we present a heuristic way for reducing the model, with the subsequent application of an ILP solver. Second, we propose the application of an iterative hybrid algorithm that makes use of an ILP solver for generating high quality solutions at each iteration. Experimental results concerning artificial and real problem instances show that the proposed techniques outperform an available technique from the literature.