A method to modify treatment plans in adaptive radiotherapy without formal re-optimization was proposed and studied. The method is based on the Cimmino algorithm in linear programming. The very fast convergence speed is obtained by over-relaxing the algorithm’s relaxation parameter. The significant advantage of applying this fast Cimmino algorithm in adaptive radiotherapy is that a very good initial guess for the algorithm from the original optimized treatment plan is guaranteed. To make the algorithm work effectively, the algorithm parameters were selected such that the fast Cimmino algorithm can simulate an unconstrained quadratic re-optimization process. A comparison between the modified treatment plans by the fast Cimmino algorithm and those by the direct re-optimization as well as the computing time between the two methods was made using two case studies. The case studies showed that the fast Cimmino algorithm modified treatment plans are closely comparable to the re-optimized plans and the fast Cimmino algorithm converges about 10 times faster or more than the re-optimization process. It is thus concluded that the fast Cimmino method studied provides a potential tool to quickly and effectively modify the treatment plan in adaptive radiotherapy without formal re-optimization. This research is partially supported by Tomotherapy Inc.