CT-guided correction during treatments of conformal prostate radiotherapy has received increased attention as a means of delivering dose more precisely to the target while sparing surrounding dose-limiting organs. However, daily corrections based on CT scans taken immediately prior to treatments must be calculated within a few minutes to be feasible clinically. Based on the observation that prostate curvatures usually do not vary significantly during the treatment course, we propose a simple and fast curve fitting approach for determining prostate position. After a daily scan is acquired, at the CT console left, right, posterior, and anterior extents of the prostate are extracted from each one of the five CT slices. The isocenter position is determined by three radio-opaque markers affixed on skin tattoos. The prostate displacements relative to the planned position in three axes are calculated by simultaneously fitting these four extents for each of five slices from the daily scan to prostate contours from the planning scan. The fitting, completed within 30 seconds, is implemented by automatic minimization of the squared error function using the Nelder-Mead simplex algorithm. This approach exploits the prostate curvatures along the longitudinal direction, thus eliminating the necessity of identifying prostate base and apex as well as physician’s daily contouring. Evaluation of 78 CT scans from six prostate cancer patients shows this method to be in excellent agreement (<1 mm mean difference) with an offline approach that computes prostate displacements based on center-of-mass displacements. We conclude that the method is accurate, simple to implement, and clinically feasible.