Purpose: A novel rotational IMRT (rIMRT) technique using burst delivery (continuous gantry rotation with beam off during MLC repositioning) is investigated. We evaluate the plan quality and delivery efficiency and accuracy of this dynamic technique with a conventional flat 6MV photon beam. Methods: Burst-delivery rIMRT was implemented in a planning system (Panther, Prowess) and delivered with a 160-MLC linac (Artiste, Siemens). Ten rIMRT plans were generated for five anonymized patient cases encompassing head and neck, brain, prostate, and prone breast. All plans were analyzed retrospectively and not used for treatment. Among the varied plan parameters were the number of optimization points, number of arcs, gantry speed, and gantry angle range (alpha) over which the beam is turned on at each optimization point. Combined rotational/step-and-shoot rIMRT plans were also created by superimposing multiple-segment static fields at several optimization points. The rIMRT trial plans were compared with each other and with plans generated using helical tomotherapy. Plans were delivered and verified using a diode array, ionization chambers, and thermoluminescent dosimeters. Results: Burst-mode rIMRT can achieve plan quality comparable to helical tomotherapy, while the former may lead to slightly better OAR sparing for certain cases and the latter generally achieves slightly lower hot spots. Few instances were found in which increasing the number of optimization points above 36, or superimposing step-and-shoot IMRT segments, led to statistically significant improvements in OAR sparing. Using an additional rIMRT partial arc yielded substantial OAR dose improvements for the brain case. Measured doses from the rIMRT plan delivery were within 4% of the plan calculation in low dose gradient regions. Delivery time range was 228-375 seconds for single-arc rIMRT 200-cGy prescription with a 300 MU/min dose rate. Conclusions: Rotational IMRT with burst delivery, whether combined with static fields or not, yields clinically acceptable and deliverable treatment plans.