Purpose:
When a prescribed course of radiation treatment is interrupted, the remaining treatment sessions must be altered. A number of compensation methods have been suggested in the literature. Some of these methods may not be accepted because of tumor underdosage, increased risk of reactions in organs at risk (OARs) and departmental policies. The goal of this research was to develop a software tool that enables the radiation oncology team to investigate available options and select the best method of compensation on an individual patient basis.

Methods:
Compensating methods differ in overall treatment time, number of compensating fractions and dose per fraction. For each method, we calculated biological effective dose (BED) and normal tissue complication probability (NTCP) of the OARs using the same tumor BED and tumor control probability (TCP) as the prescribed regimen. The suitable method was then selected as the method with the least increase in OARs’ BED and NTCP. BED values were calculated using the linear quadratic model formalism. TCP and NTCP values were estimated using Tumorlet and Lyman-Kutcher-Burman models, respectively. The gap-compensation software developed in this research accepts differential dose volume histograms and gap information as input and uses the provided database to calculate BED, TCP and NTCP values for each compensation method.

Results:
The results indicate that while the change in BED relative to the intended BED does not depend on the gap position, it is strongly dependent on the type of tumor and OARs’ tissue types: 13% for head and neck vs. 8.7% for prostate, and about 8.5% to 10% for normal tissues.

Conclusions:
A software tool was developed to allow for the selection of the best compensation method for interrupted radiation treatments. The method with the lowest change in BED and NTCP in comparison to intended program, is selected to substitute the original plan.