Purpose: MLC failure increases accelerator downtime and negatively affects the clinic treatment delivery schedule. This study investigates the use of Statistical Process Control (SPC), a modern quality control methodology, to retrospectively evaluate MLC performance data thereby predicting the impending failure of individual MLC leaves.

Methods: SPC, a methodology which detects exceptional variability in a process, was used to analyze MLC leaf velocity data. A MLC velocity test is performed weekly on all leaves during morning QA. The leaves sweep 15 cm across the radiation field with the gantry pointing down. The leaf speed is analyzed from the generated dynalog file using quality assurance software. MLC leaf speeds in which a known motor failure occurred (8) and those in which no motor replacement was performed (11) were retrospectively evaluated for a 71 week period. SPC individual and moving range (I/MR) charts were used in the analysis. The I/MR chart limits were calculated using the first twenty weeks of data and set at 3 standard deviations from the mean.

Results: The MLCs in which a motor failure occurred followed two general trends: (a) no data indicating a change in leaf speed prior to failure (5 of 8) and (b) a series of data points exceeding the limit prior to motor failure (3 of 8). I/MR charts for a high percentage (8 of 11) of the non-replaced MLC motors indicated that only a single point exceeded the limit. These single point excesses were deemed false positives.

Conclusions: SPC analysis using MLC performance data may be helpful in detecting a significant percentage of impending failures of MLC motors. The ability to detect MLC failure may depend on the method of failure (i.e. gradual or catastrophic). Further study is needed to determine if increasing the sampling frequency could increase reliability.

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