Purpose: In order to improve the correlation between gamma index pass rates and plan quality, a new method was developed to incorporate DVH structures into the gamma index analysis.

Methods: Five treatment machines were created in the Varian Eclipse platform. The original machine was created using Varian golden beam data. Deviations, representing clinical errors, were introduced in the other machines by modifying MLC transmission factors and smoothing beam penumbras. Doses for 9 Head and Neck dynamic IMRT plans were calculated, creating 36 modified and 9 original plans. The max spinal cord dose and dose to 95% of the PTV (PTV-95%) were calculated. The modified plans were compared to the original using a gamma analysis commonly used in IMRT QA. A new method of gamma analysis was performed by using the cord and PTV structures to vary the passing criteria (%/mm). The structures were extracted using Matlab and projected from a "beams eye view" onto the QA dose planes. To emphasize the importance of the dose to the structures, the passing criteria were tightened in proportion to the thickness of the structure that the beam traveled through. Pearson correlation coefficients(r-values) comparing the PTV-95%/spine dose differences and the gamma pass rates were calculated.

Results: Pearson coefficients for the max cord dose were -0.717/-0.720/-.750 for traditional 3/2/1(%/mm) passing criteria, respectively. This improved to -0.831 when using the structure dependent passing criteria. Pearson coefficients for PTV-95% were -0.729/-0.703/-.711 for the 3/2/1(%/mm) criteria and -0.812 for the structures dependent criteria.

Conclusions: Using structural information to vary gamma analysis passing criteria can result in improved correlation between gamma index pass rates and clinically relevant dose objectives. This enhances the ability of the gamma index, making it a more powerful IMRT QA tool.