Purpose: To study the effect of skull surgical clips and bone artifacts on dose distribution using proton beams for treatment planning.

Methods: Proton treatment plans with double scattering technique for ten patients were generated on patients with brain tumors having had prior surgery with skull bone surgical clips. Appropriate clinical, dosimetric and geometric margins were added for each tumor volume and dose was prescribed to clinical target volume (CTV). The CT images used for treatment planning show streaking artifacts due to the clips and there are also soft artifacts on tissue adjacent to skull bone due to high density of bone. We performed two plans for each patient; a plan without correcting for artifacts and a second plan replacing the artifacts with normal tissue. For the second plan, the artifacts were contoured and a CT numbers obtained by sampling pixels in adjacent areas without artifacts was assigned to the contours. We compared the two plans by evaluating the dose volume histogram (DVH) for tumor coverage and the mean, median, and maximum dose for normal tissue structures.

Results: Volume of CTV receiving 99% of the prescribed dose (PD) show a mean difference of 3% higher dose for artifact corrected plans. The normal tissue structures comparison shows and average dose difference of 5%, 8%, 11%, and 30% lower doses for optical chiasm, temporal lobes, brain and optic nerves for artifact corrected plans respectively.

Conclusions: In general when using artifact correction for surgical skull clips and skull bone, the tumor coverage tends to be slightly higher. Overall, the normal tissue structures tend to have lower doses depending on the volume, position and the geometry for artifact corrected plans. We recommend the correction of artifacts due to surgical clips and skull bone for brain region proton planning.