Comparison of state-of-the-art interpolation-based Metal Artifact Reduction (MAR) Algorithms for Cone-Beam Computed Tomography (CBCT)

**Purpose:** To compare four metal-artifact-reduction (MAR) algorithms in their ability to correct the typical streaking artifacts that appear in cone-beam computed tomography (CBCT) images.

**Method-and-Materials:** The goal was to compare the strengths and weaknesses of four MAR algorithms, Basic; Wei; Mazin and Meyer, using typical clinical situations where metal is present. Three clinical situations were evaluated: fiducial markers in the abdomen; hip implants and multiple dental fillings. The algorithms take original CBCT projections as input and produce a corrected image. The location of the metal is identified in the CBCT images and a forward projection identifies which pixels in the projections need to be replaced by interpolation of neighboring pixels. The three advanced algorithms extend the Basic technique with more sophisticated interpolation schemes. Wei and Meyer identify the high contrast structures using image segmentation in order to reduce their appearance in the projections before interpolation. Mazin corrects the original projections using a forward projection of the Basic correction.

**Results:** All the algorithms reduced the streak artifacts typical of metal structures. Nevertheless, depending upon the clinical task, the algorithms also added shading and streaks which reduced the overall visual impression. Images containing fiducial markers in the abdomen showed obvious improvements; images containing hip implants were improved but also showed distracting shading artifacts; and, images with multiple dental fillings all appeared visually worse than the uncorrected images. In almost all cases, Mazin outperformed the other approaches and introduced the fewest additional streaks and shading artifacts.

![Figure 1: Top Row: Fiducial Markers in an Abdomen scan. Middle Row: Two Hip implants. Bottom Row: Dental Implants in a Head CBCT. In all cases the Mazin algorithm performs best out of all correction algorithms.](image)

**Conclusions:** This work indicates that the Mazin algorithm is best suited for clinical usage of MAR. Furthermore the algorithm is fairly simple and can be computational very efficient making it well suited for clinical use. Nevertheless, the overall improvement is highly dependent on the individual characteristics of the original image. For dental implants no correction is recommended.

**References:**