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TITLE: Metal-induced streak artifact reduction by statistical reconstruction in X-ray computed tomography image of dento-alveolar region

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Metal-induced streak artifact reduction by statistical reconstruction in X-ray computed tomography image of dento-alveolar region

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Purpose

X-ray CT images in the dento-alveolar region are sometimes rendered unusable for diagnostic purposes due to the appearance of streak artifacts. They are mainly caused by the existence of metallic prosthetic appliances. The purpose of the study is to reduce metal-induced streak artifacts appeared on dental and maxillofacial X-ray CT images by the application of modified iterative restoration methods, the faster algorithm and a so-called reversal point processing.

Methods

We took advantage of the aspect that adjacent CT images often depict similar anatomical structures within the resulting collection of thin-slice images[1-3]. CT images having metal-induced streak artifacts were processed using the projection data of adjacent CT images. A modified iterative correction, the maximum likelihood-expectation maximization (ML-EM) reconstruction algorithm, was employed. It approximates between the processed image and the original projection data. First the projection data of an intact image was obtained, and then the next image which had streak artifacts was processed. The projection data of the processed image were obtained and the ML-EM method was applied to the next image again. Then the successive iterative restoration was carried out as indicated at the upper side of Fig. 1[2]. We applied the ordered subset-expectation maximization (OS-EM) reconstruction algorithm for the processing. And the ROI (region of interest) setting was applied for the reduction of the duration time and improvement of the image quality as shown at the lower side of Fig. 1. The difference in the projection data was also shown at the lower side of Fig. 1. Then it was tried that the successive processing for maxilla CT images was employed in the direction from head to foot and for mandible CT images in the direction from foot to head. We call this as the reversal point processing[3].

Results

Successive adjacent images were processed. Each iterative restoration was carried out fifty times. Metal-induced streak artifacts were observed on processed images at the initial stage, but some of them either suppressed or disappeared as the iteration progressed. The OS-EM method was possible to work for reducing the calculation loading. The small ROI setting was effective for the reduction of the duration time. The reversal point processing was effective for the artifact reduction while keeping the anatomical reproducibility.

Conclusion

The modified ML-EM method was effective to reduce streak artifacts in X-ray CT images in dento-alveolar region. Both the OS-EM method and the small ROI setting worked for the fast calculation. The reverse point processing was also effective.

References

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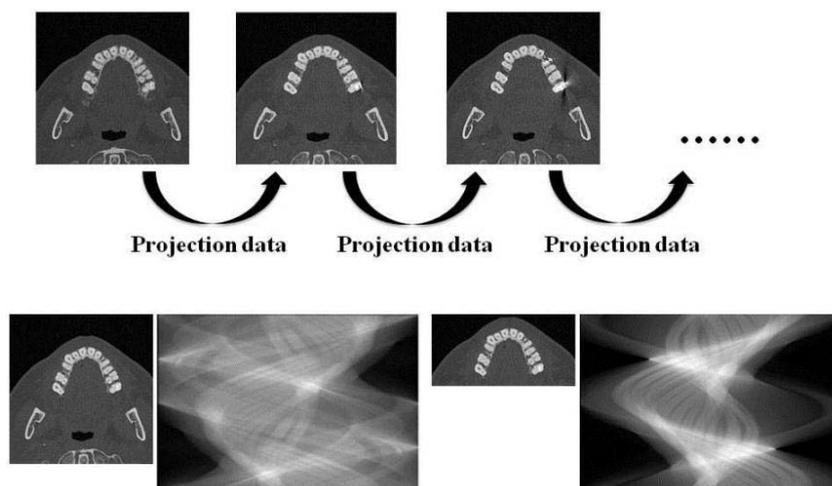


Fig. 1 Successive iterative restoration (upper half). Small ROI setting and its projection data (lower right) compared to those of original Ctimage (lower left)