

# Comparison of image quality between a digital panorama X-ray unit with a CdTe-CMOS detector and panorama X-ray units with other types of digital detectors

S. Scheidegger<sup>1</sup>

<sup>1</sup>Centre for Applied Mathematics and Physics, Zurich University of Applied Sciences, Winterthur  
mail: [scst@zhaw.ch](mailto:scst@zhaw.ch)

## Introduction

Progress in digital detector development is playing an increasingly important role in the area of dental X-ray methods [1]. One new development is CdTe detector technology. Here, a CdTe layer replaces the fluorescence layer. X-ray quanta release electrically charged particles in this layer, which then flow in an electric field in the direction of a diode matrix. In this contribution, a comparison between the image quality of a digital panorama X-ray unit with a CdTe detector (ART Plus ) and other more standard digital panorama units will be presented. Earlier studies [2,3] are dedicated to the difference between film based and digital panoramic radiography and have a more qualitative nature.

## Material and Methods

Test images were used for comparing image quality. For the sake of practical relevancy, a special anthropomorphic bone phantom was used. The test images were analyzed with Matlab using the Image Tool Box. A small exactly defined area identical for all panoramic images was cut out of the X-ray images and used to determine the MTF. For estimation of image noise, the standard deviation of the gray scale values of selected parts of the test images and images of a water phantom were calculated.

Another difficulty is mechanical instability which can lead to shifts in the positions of the structures in the image. To determine these shifts, a series of 10 pictures was taken one after another with two devices (Art Plus and Pro Max). Two successive x-ray images were then used to calculate the difference image.

## Results

Measurement of the MTF clearly shows good resolution for the Art Plus unit ( $MTF(50\%) = 5.61 \text{ lp / mm}$ ) compared to the average of all 5 tested units ( $3.44 \pm 1.55 \text{ lp / mm}$ ). To investigate image noise, the ratio was calculated between average gray scale value and standard deviation in a  $32 \times 32$  matrix ( $R_{32 \times 32}$ ). Compared to the other units, identical regions in the image are less noisy for the Art Plus unit ( $R_{32 \times 32} = 92.28$  and  $R_{32 \times 32} = 19.40 \pm 11.00$  for the other units). Also image displacement of a series of images was determined for the Art Plus and the Pro Max unit. The displacements were between 1-5 Pixels for both.

## Discussion

The visual impression was confirmed by the measured data. The Art Plus's CdTe-CMOS detector displays a high picture resolution compared to the other devices.

With the exception of the first two pictures in each series, the image shifts measured in the Art Plus and Pro Max devices are small and amount to only a few pixels (a mechanical displacement of the skull phantom can be ruled out).

## References

- [1] Van der Stelt, P.F. (2005): Filmless imaging: The uses of digital radiography in dental practice. *J. Am. Dent. Assoc.*, **136**(10), 1379-1387
- [2] Molander, B., Gröndahl, H.G., Ekestubbe, A. (2004): Quality of film-based and digital panoramic radiography. *Dentomaxillofac. Radiol.*, **33**, 32-36
- [3] Gijbels, F., De Meyer, A.M., Bou Serhal, C., Van den Bossche, C., Declerck, J., Persoons, M., Jacobs, R. (2000): The subjective image quality of direct digital and conventional panoramic radiography. *Clin. Oral. Invest.*, **4**, 162-167