CBCT as a diagnostic and treatment planning tool and assessment of low dose programs for endodontic follow-up cases

Author: Dr Sirpa Pöyry, Finland

**Introduction**

Endodontics is a field of dentistry that requires precision and accuracy at their highest levels. The same preconditions apply to the image quality needed for endodontic diagnosis. Cone Beam Computed Tomography (CBCT) has turned out to be an excellent point-of-care imaging solution for an endodontic practice as the quality and quantity of diagnostic information is far superior to any other imaging modality.

Even though the radiation dose of CBCT imaging is naturally higher in comparison to 2-D imaging, the dose level is still very reasonable and quickly offset by the yielded diagnostic data.

Radiation hygiene is, nevertheless, constantly a hot topic both at academic and practical discussions within dentistry. The rapid technological progress of CBCT technology has discovered new means of decreasing the patient dose while improving, or at least maintaining, the diagnostic information intact. Low-dose programmes might not instantly appear to be compatible with the resolution requirements of endodontic images, but new innovations open up the avenue for decreased dose also for endodontic patients.

This case study describes how CBCT provides key information of relevance in endodontic diagnoses and treatment planning and how lower resolution and thus lower radiation dose may be totally applicable also for follow-up imaging of certain type of endodontic cases. It is just a question of justification and optimisation of the patient dose versus needed image quality—about choosing the right resolution for the job.

**Case report**

A 46-year-old male patient came to the clinic for a check-up. A native panoramic image (CRANEX D, dose area product DAP 70 mGy/cm²) revealed a symptomless apical periodontitis in a root canal treated d17. Root canal treatment had been performed 4 years earlier (Fig. 1).

As there was no healing to be detected, it was necessary to make a further treatment plan. The patient had been previously surgically operated on for cancer, and at the time of the diagnosis there was no information of follow-up care for the disease.

In order to acquire more information, to confirm the diagnosis and to find out the root morphology of the d17, a CBCT scan (CRANEX 3D, FOV 6x4 with high resolution, exposure values 90 kV, 8.0 mA, 6.10 s, DAP 380.7 mGy/cm²) was taken as a further radiological examination (Fig. 2).

Retreatment would have been one option of treatment, but because of the cyst-like finding in the apical area pushing the maxillary sinus bottom up, root resection was chosen. CBCT images proved the root morphology to be favorable for it, and as a result, an apicoectomy was performed one month later. Both the buccal and palatal roots were filled with Biodentin retrograde fillings.
The follow-up control took place 21 months post-operatively. At the clinical examination, the tooth appeared to be symptomless and the intraoral status was stated to be normal. For radiological examination, a low dose CBCT scan was taken (CRAN EX 3Dx, FOV 5x5, 90 kV, 4 mA, 1,17 s, DAP 40,5 mGy/cm²) and it showed good healing in the apical area (Fig. 3).

Conclusion and discussion

In this case, CBCT imaging technique was of great assistance to the dental team while making the treatment plan and following up with the patient. The radiological findings confirmed the suspected pathoses and gave a firm basis for accurate diagnosis and treatment planning.

CBCT has turned out to be an ideal diagnostic tool in endodontics, which is a sensitive playfield of tiny details, where each move has to be carefully considered and justified. CBCT literally provides endodontists with another dimension, and therefore greatly contributes to the efficiency of the clinical work. The benefits of CBCT may be summarised as follows:

- Gives diagnostic confidence.
- Acts as a navigator during the treatment process.
- Makes clinical work safer.

Concerning low-dose imaging programmes, low resolution has generally not been an option for endodontic imaging due to the accuracy and precision of required image quality. The current advanced reconstruction algorithms, however, enable good enough image quality even with a low radiation dose, which makes the low dose programmes a reasonable alternative to be considered when endodontic follow-up cases are concerned.

In this case, the low-dose CBCT image was shown to be good enough for following up the healing process. The effective radiation dose was 4µSv, whereas the dose with the same FOV (5x5) and standard resolution would have been five times higher, 20 µSv, equaling thus the radiation dose of a native panoramic image. However, dose sensitivity did not come at the expense of the image quality, but the needed diagnostic data for the follow-up evaluation was well provided by the low dose option._