Carestream DENTAL

CASE STUDY

Seeing Beyond the Scan: Role of CBCT goes beyond Digital Dentistry Planning

by Prof. Ingrid Rozylo-Kalinowska

Digital dentistry relies on accurate imaging as the foundation for every procedure, whether simple or complex. Traditionally, two-dimensional radiographs guided clinical decision-making, but the advent of cone beam computed tomography (CBCT) has transformed diagnostic capability, offering a comprehensive three-dimensional view of dental and maxillofacial structures. However, advanced imaging is only as valuable as its interpretation. Specialist radiologists play a crucial role in providing detailed, systematic reporting, ensuring that treatment plans are both appropriate and safe. This case highlights the importance of CBCT and expert radiological input in optimising digital dentistry workflows and safeguarding patient outcomes.

CASE

A male patient, aged 65, with non-remarkable medical history, was referred by his dentist for a cone beam computed tomography (CBCT) scan before planning dental implant placement. The patient was completely edentulous in the upper jaw, while in the mandible only three teeth were preserved, which served as a support for a fixed denture. Although the indications for the CBCT examination included only dental implant treatment, a large field of view (FOV)—16x17 cm volume—was obtained by means of Carestream Dental's CS 9600 CBCT device. As a consequence, the whole volume had to be carefully examined and reported.

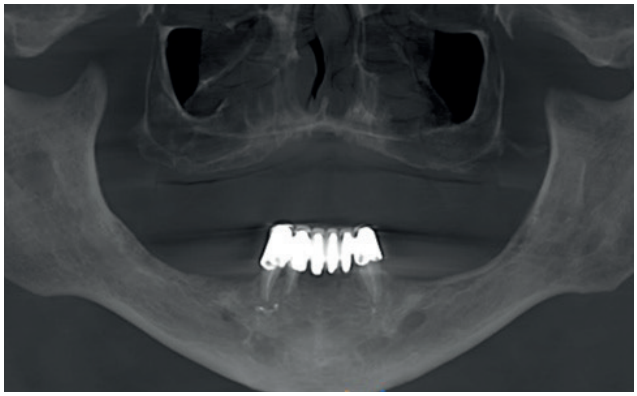


Fig. 1. Reformatted panoramic view.

The initial evaluation of the reconstructed panoramic view (Fig. 1) confirmed that there were no teeth in the maxilla, and in the

anterior mandible only teeth nos. 43, 42 and 33 were preserved. All three teeth were treated endodontically, and in the case of the canines, root canal overfilling was observed. No periapical lesions were noted. The teeth served as support for a fixed prosthetic appliance.

The analysis of the curvilinear and cross-sectional views in thinner sections (Figs. 2 and 3) allowed for evaluation of the alveolar bone as potential support for dental implants. In the maxilla, the alveolar bone was atrophic and the height of the residual alveolar ridge was very small so it could not provide sufficient anchorage for dental implants.

Planning of dental implants was possible only in the posterior mandibula. However qualitative evaluation of the mandibular bone showed some rarefication which could compromise the primary stability of the implants (Fig. 2).

The report of the case seemed quite straightforward, however, more attention had to be paid to all other structures visible in this large FOV.

Further evaluation of the volume revealed several incidental findings that did not influence the dental implant treatment, but had to be included in the report, and potentially required further diagnostic imaging or follow-up.

The size of the incisive foramen was larger than usual (Fig. 4), which may be indicative of an incisive foramen

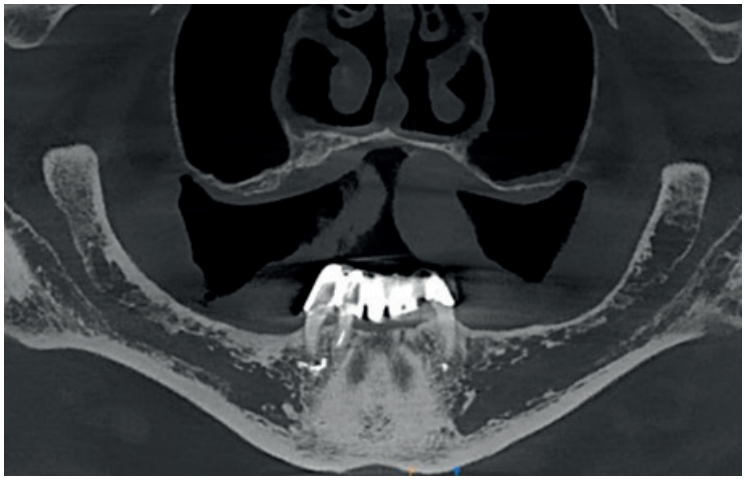


Fig. 2. Panoramic view in thin slice.

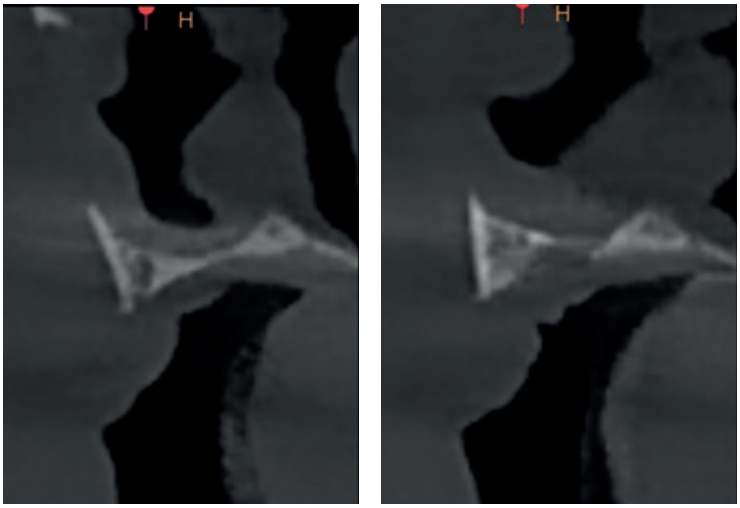


Fig. 3. Cross-sectional images of the alveolar bone in the area of the missing upper incisor confirm very small height of the residual alveolar ridge

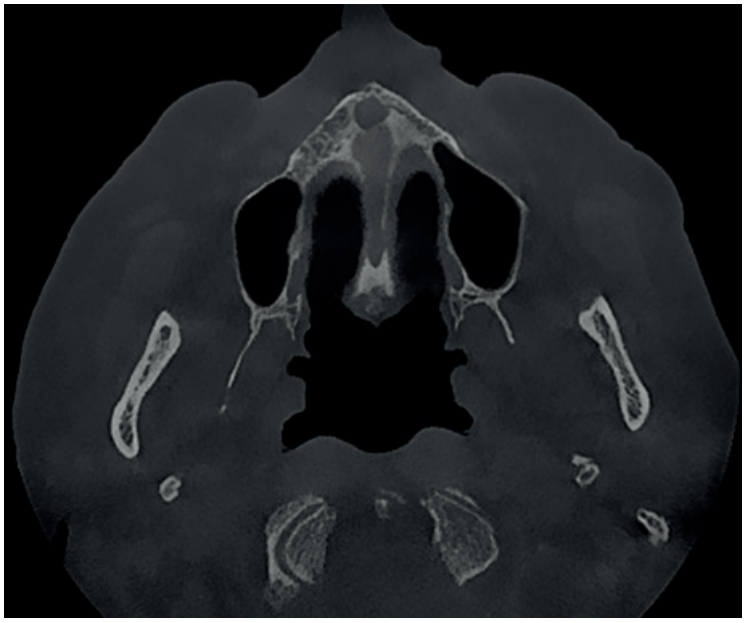


Fig. 4. Axial view at the level of hard palate demonstrates enlargement of the incisive foramen.

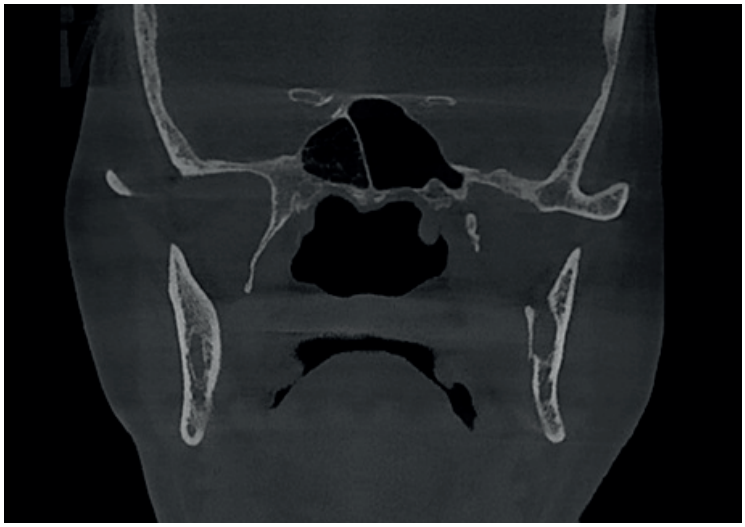


Fig. 5. Coronal cross-section at the level of sphenoid sinus presents streaks in the right compartment of the sinus.

cyst that in symptomatic patients, and with further progression, would require surgical treatment.

Some streaks in the right compartment of the sphenoid sinus, suggesting thick mucus, were noted (Fig. 5).

Next, the bony structures of the cervical spine were evaluated, and the images were consistent with osteoarthrosis. It presented as narrowing of joint space between the anterior arch of the C1 vertebra and the dens of the C2 vertebra together with subchondral sclerosis and small osteophytes (Fig. 6). Also, the height of the C3-C4 joint space was reduced.

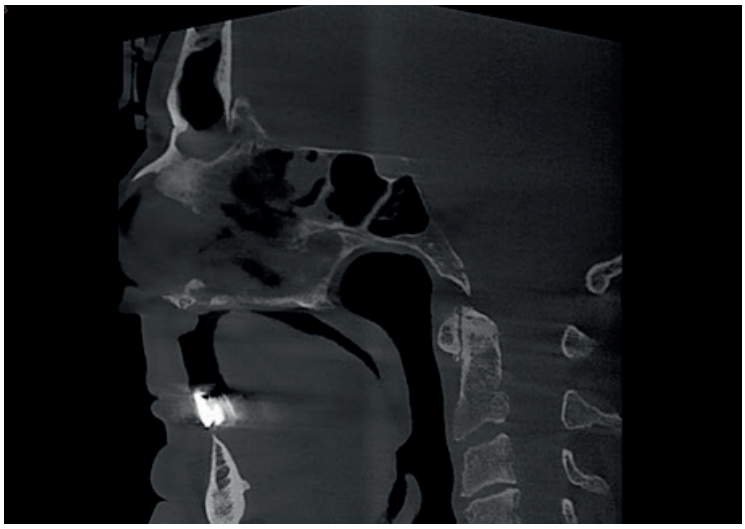


Fig. 6. Sagittal slice obtained in the midsagittal plane allows for evaluation of osteoarthrosis of the cervical spine.

Afterwards, a well-defined bony outgrowth was noted in the anterior ethmoid cells on the left (Fig. 7). The radiographic image suggested an osteoma, which is a benign tumour composed of mature bone cells, often located in paranasal sinuses. Although benign, the lesion is characterized by growth potential and may require surgery when larger and compromising sinus drainage.

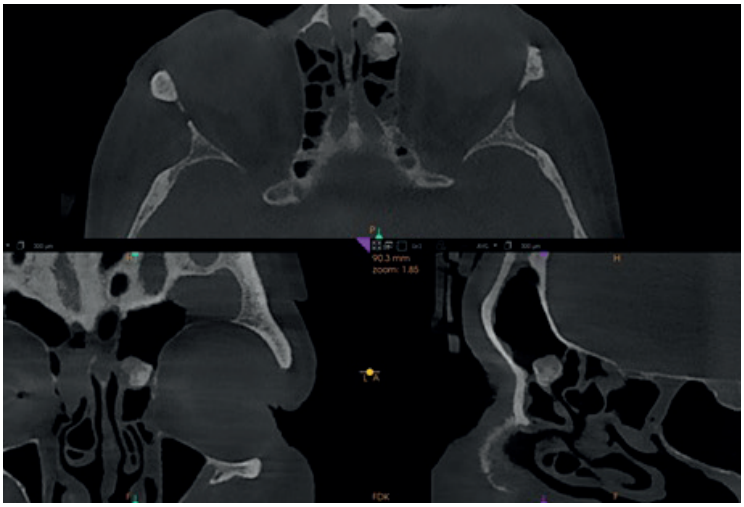


Fig. 7. MPR views of the left ethmoids show a well-defined bony lesion.

Further analysis focused on soft tissue calcifications. Calcified atheromatic plaques were revealed in different locations along the course of carotid arteries—both in the neck (Fig. 8) and in the intracranial sections of the internal carotids (Fig. 9). A calcified atheromatous plaque in the carotid arteries is a significant finding that



Fiig. 8. Bilateral calcifications in atheromatous plaques in the neck are visible in the coronal image.

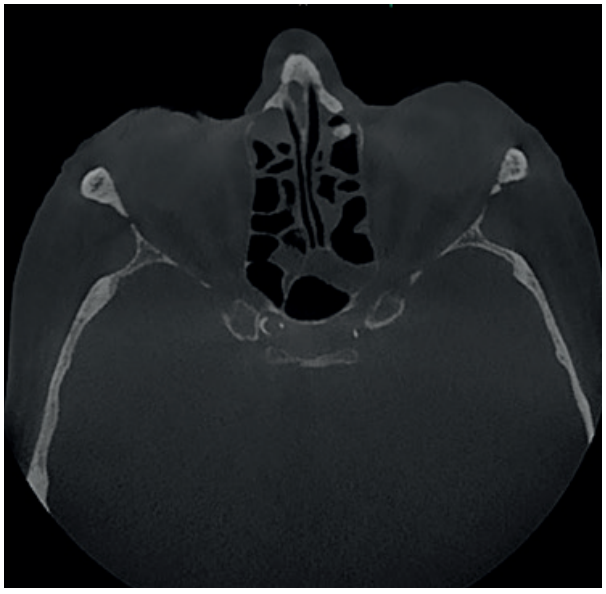


Fig. 9. Axial image presents calcification in intracranial portions of the internal carotid arteries.

suggests advanced atherosclerosis, which can increase the risk of stroke, though the exact risk depends on several factors. If not discovered early, carotid artery calcifications may require further diagnostic work up in the form of Doppler ultrasound examination of carotid arteries or angio-CT examination.

The case demonstrates the importance of the choice of the FOV in CBCT which is a critical factor in optimizing radiological protection. By selecting the smallest FOV necessary for the diagnostic task, unnecessary exposure to adjacent anatomical structures can be minimized, thereby reducing the patient's overall radiation dose. This approach aligns with the ALARA (As Low as Reasonably Achievable) principle, promoting patient safety without compromising diagnostic quality. Proper FOV selection also aids in limiting scatter radiation and improving image quality within the region of interest. Guidelines of numerous scientific associations highlight that the smallest possible FOV should be chosen in relation to specific indications.

However, sometimes clinical practices are not in line with the guidelines, and larger FOVs are selected by clinicians. Then it is the practitioner who should take the responsibility for reporting the whole volume as some incidental findings may have medical consequences. Depending on local laws and regulations in different countries, large FOV CBCTs can be reported by medical radiologists only, while in many countries the regulations are less strict and dentists can operate and report CBCT machines regardless of the size of the FOV. It should be highlighted that dental curricula, both pre- and postgraduate, may not include information on radiological evaluation of structures located outside the maxilla and mandible. Therefore, the practitioners do not obtain sufficient information to be able to evaluate large FOVs comprising the head and neck. According to the famous 19th century sentence, attributed to either Henry Bergson or Robertson Davies, "the eye sees what the mind is prepared to comprehend." This powerful quote is unquestionably true in radiology and means that perception of an image is not just about vision—it is about training, experience, and expectation.

This case illustrates how large FOV CBCT scans can reveal clinically significant findings beyond the immediate scope of the proposed treatment planning. While some of these findings require further clinical tests and diagnostic imaging to further assess risks to the patient's general health, their identification underscores the importance of thorough evaluation and specialist reporting.

In this era of digital dentistry, where precision and patient safety are paramount, comprehensive interpretation of CBCT volumes is essential to ensure that digital workflows are built on a foundation of accurate, responsible diagnostics.

PROF. INGRID ROZYLO-KALINOWSKA BIOGRAPHY



Prof. Ingrid Różyło-Kalinowska, MD, PhD, DSc, is Head of the Department of Dental and Maxillofacial Radiodiagnostics at the Medical University of Lublin, Poland. A specialist in radiology and diagnostic imaging, she has published extensively, authored and co-edited leading textbooks on CBCT and digital workflows, and serves as Editor-in-Chief of the Journal of Stomatology.

Past President of the European Academy of DentoMaxillofacial Radiology, she is a frequent invited speaker at international congresses, with particular expertise in cone beam computed tomography and its role in safe, precise digital dentistry. Her contribution to the upcoming joint events in Venice — the DDS Congress and the IADMFR meeting — underscores the importance of radiological reporting as the foundation of effective digital dentistry planning.