

Denta Scan

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ABSTRACT

DentaScan is a unique new computer software program which provides computed tomographic (CT) imaging of the mandible and maxilla in three planes of reference: axial, panoramic, and oblique sagittal (or cross-sectional). The clarity and identical scale between the various views permits uniformity of measurements and cross-referencing of anatomic structures through all three planes. Unlike previous imaging techniques, the oblique sagittal view permits the evaluation of distinct buccal and lingual cortical bone margins, as well as clear visualization of internal structures, such as the incisive and inferior alveolar canals.

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INTRODUCTION

Computed tomography (CT) with multiplanar reformatting is considered to be the most reliable technique for the assessment of bone measurements and localization of anatomic structures, although it has disadvantages like greater radiation exposure and cost(1-3). Multiplanar reformatted CT images produce three basic images: axial images with a superimposed curve, cross-sectional images, and panoramic images.

A Dentscan examination is a specialized type of computed tomography study (CT or "CAT" scan), which is performed on a conventional CT scanner used to obtain true cross-sections of the mandible and maxilla from the easily obtained CT scans for patients with cyst, tumours, distractions, accuracy of root canal obturation, jaw growth, stages of tooth development, dental implant, cases of fractures in either the mandibular or maxillary arch(4).

Dentscan is used in advanced computer programs to analyze an X-ray study by providing detailed two-dimensional and three-dimensional images and enable nearly diagnosis and plan the details of the surgery with accuracy, well before the operation.

Routine dental x-rays are two-dimensional; they only show the location of the teeth and the height of the bone. These x-rays

are often distorted, and they cannot depict the thickness of the jawbone; while a Dental CT Scan, on the other hand, is distortion free. It illustrates the actual make-up of the bone and provides three-dimensional and cross-sectional views of the jaws. The life-sized images allow to accurately measure the amount and density of bone(5).

USES

- It allows the visualization of internal bone morphology in three dimensions; therefore the dental surgeon can plan his treatment precisely.
- In cross sectional view, observation regarding bone quality, density can be made typically by direct measurement, if they are present in life size format.
- The main use of dentscan today is in the pre-operative planning and pre-operative modeling of endosseous dental implants and subperiosteal implants(6).
- It enables the dental surgeon to visualize the bony structures pre-operatively; he does not have to make decisions at the time of surgery when the mucoperiosteal flap is already elevated to visualize the bony structures directly.
- Dentscan CT provides the surgeons an operation with information of the internal structures that cannot even be gained by direct intra-operative visuali-

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Figure 1: Figure shows the location of mandibular canal in mandible

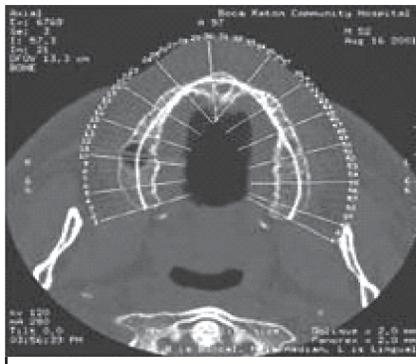


Figure 2: Cross-section of the maxilla

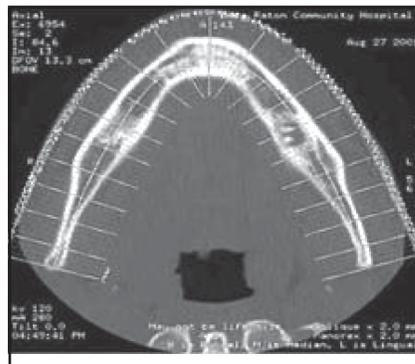


Figure 3: Cross-section of the mandible

zation. It can also be used for the evaluation of cysts, tumors, and fractures in the jaw(7).

- In the mandible, the precise location of the mandibular canal is critical(8). (Figure 1).
- For the maxilla, the location of the floor of the maxillary sinuses is necessary.
- It is important to understand that the anatomy of these bones and surrounding structures is unique to each patient(4, 5, 9).

PREPARATION MADE FOR A DENTASCAN

The examination is very simple and painless, and can easily be performed in a matter of minutes.

- Wear loose comfortable clothing without metal snaps or zippers, such as a cotton sweatsuit. Patient might be asked to change into a hospital gown.
- Do not wear any makeup or jewelry
- Remove dentures, wigs, hairpins and

hearing aids

- Notify the radiologist if the patient is pregnant or breastfeeding
- Patients who are allergic to iodine and shellfish should be medicated prior to the exam

PATIENT'S POSITIONING AND EXPOSURE PARAMETER

In Dentascan the images are acquired by a high resolution spiral CT equipment.

The mandibles are maintained in a fixed positioning on a styrofoam surface, attached to the head holder of the CT equipment in order to stimulate the patient's correct positioning in which the mandibular base are perpendicular to the horizontal plane.

2 mm thick axial tomographic sections are made with 1 mm intervals at 80 kV and 60 mA and field of View (FOV) of 15.8 cm. The images obtained through this procedure are denominated as standard-position

images (SP).

New axial sections are performed with the mandible in the same fixed position but with a deviation of the gantry angle in the two directions, +19 and -19 to simulate mandibular inclination.

Using this principle, it was assumed that when gantry are inclined to +19 it simulated a lower inclination of the mandible and a -19 gantry position simulated an upper inclination. Those are respectively denominated as image with lower mandible inclination (LP) and image with upper mandible inclination (UP).

After that, all the axial CT data is transferred to a work station, to generate panoramic and cross-sectional reformatting images by the Dentascan software(5).

Those images are printed on a radiographic film by a chemical printer.

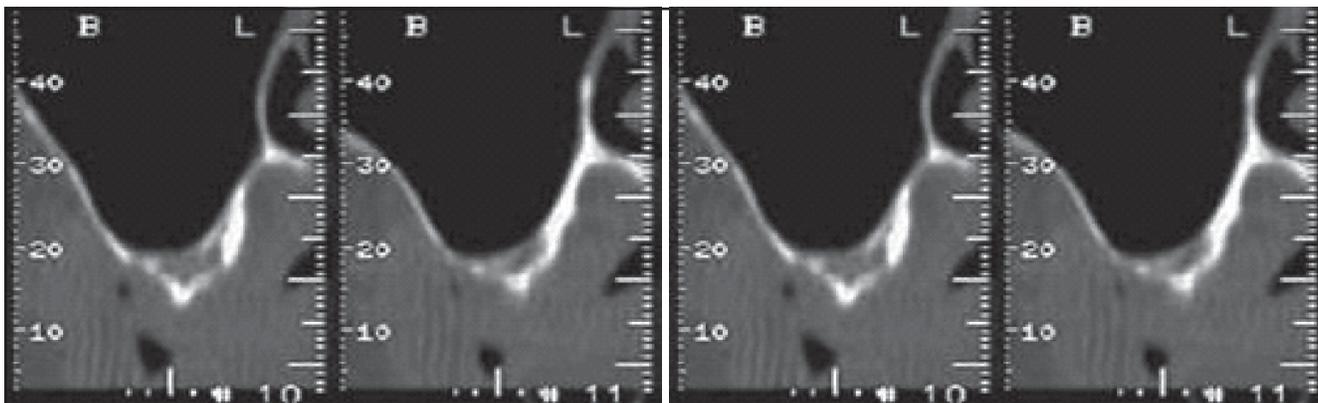


Figure 4: Figure showing poor bone height (left) and adequate bone height (right) in a dentascan

INTERPRETATION OF DENTASCAN

Axial scans at 1 mm are obtained continuously through either the maxilla (Figure 2) or mandible (Figure 3). Using the axial scan through the roots of the teeth, the curvature of the alveolar ridge is drawn on the computer screen. Software program then produces sequential oblique cross-sections every 2 or 3 mm around the entire curvature of the alveolar ridge. Each of the cross-sections is sequentially numbered and matched to tick marks on the axial views. Finally, five panoramic views are obtained and the oblique views are keyed to the panoramic scans as well (10, 11).

Advantages

- Bone height and width (Figure 4)
- Identification of soft and hard tissue pathology
- Location of anatomical structures like: Interdental Canal
- Measuring the vital qualitative dimensions necessary for implant placement

Method

Patient arrives at the clinician office and after being examined, looking out for cyst, tumours and fractures. Dentascan is a great contribution to address surgery, encouraging long term success. Through the DentaScan, a series of axial slices are generated and stored by the radiologist on his computer. These slices are converted by the dentascan radiology module and then copied on to the CD – Rom to be sent immediately to the surgical specialist.

Denta Scan networks the axial slices to show three different slice types per screen: axial, panoramic and sectional.

Denta scan allows a much faster, easier, efficient and precise study of the CAT scan. Real axial slices will usually be around 1mm, with the option of the even smaller slice parameters (0.5mm).

Denta scan generates up to 32 panoramic images showing the mandibular canal and allowing the highlighting of the mental nerves path (visible both in the panoramic and sectional slices) and enabling the detection of some dental pathologies(8). It can also be used for the evaluation of cysts, tumors, and fractures in the jaw(7).

It offers great reassurance to the patients'. 3D simulation offered by Dentascan will make them feel much secure during the surgery.

The clinician can include the final report with intra- operative comments and recommendations, as well as a printout of all information generated by the Dentascan. The Dentascan substantially increases the probability of success in cases. The clinician or radiologist defines the panoramic curve in an axial slice, which will be used as a reference for the rest of the panoramic slices. In case of improper positioning of the patient, the panoramic curve can be reformatted, thus avoiding having to repeat the scan.

Information in the slices is reworked to display three different perspectives: axial, panoramic, and sectional, obtaining 3D data.

Multiple sectional images enable visual inspection of the cortical thickness, bone trabeculation, intrabony defects, mental nerve location highlighted in the panoramic slice.

Maxillary and mandibular evaluation is done: bony defects, impacted roots, hypertrophy of sinus mucosa, sinusitis, deviation of the nasal septum, nasal cornets conditions. A list of bone densities can be generated. All surgical planning can be printed and taken into the operatory.

OUTCOME

In difficult cases Denta Scan is being used as an diagnostic tool in treatment planning and identification of several important issues like:

- Revealing difficulty to detect pathology.
- Correct assessment of bone trajectory to avoid iatrogenic injury.
- Use of CT Scan / surgical template to relate tooth to bone relation.
- Choosing appropriate implant shape to fit residual bone.

CONCLUSION

Routine panoramic radiographs are not optimal for this type of evaluation. They are unable to determine the width of

the mandible and have up to 25% distortion. So Denta Scan is a valuable tool for preoperative planning especially in immediate implants and in critical situations like posterior maxilla and posterior mandible.

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