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SOREDEX®
Dentomaxillofacial Case Report Booklet Winter 2014

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Dear colleagues, distributors and friends,

Science is a progressing process, progressing much faster than we are able to realize. Information is produced and delivered in many different ways and in such high numbers that it is hard to figure out which one is important and which one not.

For this reason, scientific CBCT research and development have to be implemented into the manufacturing of 3D units – a challenge, which SOREDEX® tackles by establishing innovative solutions following the credo “The Right Tool for the Job”.

More than 20 scientific studies in CBCT imaging, our collaboration with several partners like the University of Belgrade, University Hospital of Tampere and renowned clinics in Banja Luka, Germany and Finland wipe out the dust in the brains, making the minds up for new views and broadening the horizon of scientific knowledge.

SOREDEX® is proud to be able to offer you an opportunity to be a part of this innovation and to provide you with information about dedicated clinical cases related to CBCT and CBCT imaging all around the world, collected and reviewed by the SOREDEX® International Editorial Board.

The first edition of the SOREDEX® abstract booklet was launched at the 3rd SOREDEX® International 3D Workshop in September 2013 and you are holding the second edition in your hands right now. By publishing these booklets SOREDEX® aims to enhance its scientific status and to share relevant clinical knowledge. These efforts SOREDEX® will pursue also in 2014.

Yours sincerely,

Ms. Tiina Holkko, VP, General Manager, SOREDEX
Dr. Jörg Mudrak, DDS, DMD
The patient was treated with conventional scaling and root planing and she was given oral hygiene instructions and prescribed 0.12% chlorhexidine gluconate mouthrinse (twice a day). Reevaluation was conducted in 6 weeks and it revealed 6 intrabony defects deeper than 5 mm. The patient was able to maintain her plaque index <15%. Notably, there was no resolution in PD or BOP.

Subsequently, the patient underwent a flap surgery for the debridement of all periodontal defects. At the time of the surgical intervention, intrasulcular incisions were made from mesial tooth #22 to distal tooth #27. A full-thickness flap was reflected facially and palatally. The defect was thoroughly debrided with ultrasonic and hand instruments. A 3-wall intrabony defect was detected along the distal aspect of tooth #25 an #26. For the studied periodontal defect site, the bone level (BL) measurements were taken using recording device. K-file (size # 60) was placed in the groove, and a rubber marker was positioned next to the lower surface of the device. K-file length between rubber marker and the tip of the K-file was measured using a ruler, representing the clinical bone level. All intrabony defects were reconstructed using grafting material. To avoid overfilling of the defects, the alveolar crest served as the limit line. The flaps were repositioned and closed using a standard procedure. Postoperative medications included non-steroidal anti-inflammatory drugs (as needed) and a chlorhexidine mouthrinse. A postoperative visit was scheduled in 7 days when the sutures were removed.

Radiographic evaluation

In order to visualize the alveolar bone status, the following radiological procedures were used:

1. Panoramic radiograph method
2. Cone-Beam Computerized Tomography, CBCT (SCANORA® 3Dx, SOREDEX, Finland)

Panoramic radiographs were used in patient selection and in defining the teeth that were used for this study. Preoperative CBCT imaging was performed using the SCANORA®3Dx. During 3D imaging recording device was used. Marked reference points on the device (filled grooves) were served to obtain linear measurements on CBCT scans. Linear radiographic measurements (radiographic bone level (rBL)) were made from the CBCT scan images in a selected sagittal section. Images were analyzed using the OnDemand3D™ software supplied by SCANORA® 3Dx device. Using RULER tool, distance between marked lower edge of grooves’ midpoint and the deepest point of the bony defect was measured. These measurements were compared with relevant clinical measurements obtained during surgical procedure in order to determine the accuracy of radiological evaluation.
Results and Discussion

Bone level obtained during the surgical procedure (clinical measurement) was 20 mm, and linear radiographic measurement obtained by analyzing CBCT image was 19.7 mm. The measurements differed about 0.3 mm, and this finding is associated with using a ruler to measure the K-file length to the nearest millimeter.

The main goal of the study was to estimate if the measurements obtained by CBCT may replace the surgical re-entry measurements. It was found out that linear distances on CBCT images provided satisfactory information.

However, additional clinical studies with more patients are necessary to further assess the use of CBCT imaging as an appropriate adjunctive diagnostic tool for evaluating the responses of intrabony defects to regenerative techniques and to confirm our results.
Local risk factors include oral-surgery interventions, such as tooth extraction, implant placement etc., but also chronic irritations (inadequate prosthetic dentures), and chronically periodontal diseases. In the majority of reported cases, local trauma, particularly tooth extractions, appeared to be the direct cause, in fact, the trigger factor in developing BRONJ, yet there were reported cases that BRONJ occurred spontaneously, with no previous dental treatment, or trauma.

CASE REPORT

A 62-year-old female patient was referred to our clinic due to non-healing alveolar socket 5 months after upper molar extraction. (Fig. 1)

The medical history showed that the patient had suffered from breast cancer 9 years earlier (Oct 2004). She underwent left radical mastectomy (histopathological finding confirmed a carcinoma lobulare) and was treated with hormonal therapy (Nolvadex). In 2011 the patient developed a pathological fracture of the cervical spine (C5 and C6) and the lumbal spine (L1). She had then started to receive BPs therapy (Zometa 4 mg i.v. per month). A tooth extraction, performed in February 2013 (left maxillary tuber/ tooth 27), showed at the first view no signs of an oro-antral fistula (Fig. 2).

The Importance of CBCT in Bisphosphonate Related Osteonecrosis of the Jaw (BRONJ)

Bisphosphonates (BPs) represent a class of drugs that is applied in the therapy of different pathological diseases related to bone. Their main role in bone metabolism is to inhibit the osteoclast function, so these drugs act as potent devices in suppressing the bone resorption process.

Considering the presence of two phosphonate groups with high affinity for calcium ions in their chemical structure, BPs have the ability to accumulate predominantly in bones. According to differences in side chain of the chemical structure, related to the presence or absence of a nitrogen atom, BPs are classified in two different groups: nitrogen, containing (aminoBPs) and non-nitrogen, containing (non-aminoBPs) drugs.

These two groups of bisphosphonates also differ in the mechanism by which they inhibit the osteoclast’s action. Aminobisphosphonates (Pamidronate, Nerdronate, Olpadronate, Ibandronate, Risedronate, Zoledonate) act directly on HMG-CoA reductase (Mevalonate) pathway, by binding and blocking the enzyme farnesil diphosphate synthetase (FPPS).

In 2003 Marx described non-healing and painful exposures of jaw bone after intravenous administration of potent aminobisphosphonates in patients with multiple myeloma and metastatic bone lesions, and soon, this adverse effect was named Bisphosphonate Related Osteonecrosis of the Jaw - BRONJ.

BRONJ became in a short time the main and most speculated adverse effect of the BPs therapy. In 2009 the American Association of Oral and Maxillofacial Surgeons (AAOMS) defined the following criteria for BRONJ:

Presence of exposed necrotic bone in maxillofacial region for more than 8 weeks in patients who are currently taking, or have taken bisphosphonates, with no medical history of radiation therapy to the jaws. Long-term therapy and intravenous administration of BPs are associated with increased risk for developing BRONJ.
Thanks to the clinical information, provided by these CBCT images, the pathology could be reclassified as BRONJ stage 3. A biopsy of the named anatomic structure, excluded malignancy and showed Actinomycosis as the differential diagnosis. The treatment of this bacterial induced disease demands an adequate specific antibiotic therapy and was started right away.

Evaluating the literature, the therapy of BRONJ, associated with Actinomyces is still challenging. According to BRONJ stage, the surgical resection of necrotic bone and debridement of the maxillary sinus would be the method of choice in the future, following the initial antibiotic therapy.

It could be concluded that BRONJ is a serious negative side effect of bisphosphonate therapy, impacts negatively the patients’ quality of life, is painful, non-healing and often without adequate response to applied therapy, especially when it has not been recognized in time. BRONJ certainly requires attention and further investigation. Effective treatment concepts could be achieved if - at least – the etiopathogenesis could be clarified. CBCT could be of great importance in the estimation of osteolytic process invasion and staging of the BRONJ disease.

Editor’s comment: Actinomycosis is an infectious bacterial disease caused by Actinomyces species such as Actinomyces israelii or A. gerencseriae. It can also be caused by Propionibacterium propionicus, and the condition is likely to be polymicrobial aerobic - anaerobic infection. (Wikipedia)
The Use of CBCT in Anterior Part Mandibular Fractures

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Standard panoramic radiography (Panoramic radiograph) has diagnostic limitations in the anterior part of the lower jaw due to superimposition of the spine. Computed tomography (CT) is the method of choice for accurate diagnosis in such cases. With regard to mandibular fractures it has been stated that CBCT is superior to standard and panoramic radiography in detection of condylar and coronoid fractures and the fractures of the anterior part of the mandible(1,2,3). It was found out that CBCT was useful to detect unfavorable sagittal split fractures of the mandible, which is necessary for accurate treatment planning and screw placement(4). Although it is reasonable to assume that CBCT would perform similarly to multislice CT in the diagnosis of mandibular fractures(3), it is potentially more beneficial for the patient due to lower radiation dose and lower cost than CT(1).

A case report

A 65-year-old patient who suffered a serious trauma in a car accident showed up at the clinic with hematoma and swelling on the left cheek and neck with strongly expressed trismus. Intraoral examination showed an open wound with blood clots on the floor of the mouth. Palpatory there was severe pain; mandibular fragments were mobile with present crepitations. The panoramic radiograph (Fig. 1) showed a fracture line on the left side of the anterior mandible and fragment displacement. After the initial panoramic radiograph, a CBCT of the mandible (Fig. 2 and 3) was performed and it was clear that mandibular fracture in this case was multifragmentary with great displacement of the bone fragments.

Fig. 1. Panoramic radiograph.

The third, axial dimension of CBCT, revealed the longitudinal fracture line, which goes through the mandibular body from lingual to buccal. Thanks to CBCT it was possible to develop an adequate treatment plan - open reduction and internal fixation (ORIF) with two bicortical screws and one miniplate positioned in the right manner. Postoperative CBCT showed the mandibular fragments in anatomical position with osteosynthesis material placed (Fig.4 and 5).

Fig. 2. CBCT shows longitudinal fracture in the anterior part of the lower jaw.

Fig. 3. 3D CBCT- occlusal view.

Fig. 4. CBCT after surgical treatment.

Fig. 5. 3D CBCT after ORIF with miniplate and two screws.
An additionally acquired CBCT visualised that the lingual splaying was avoided, which could not be seen at the panoramic radiograph (Fig. 6).

The diagnostic value of CBCT technology could help to identify additional features of mandibular fractures and could influence to the modality of treatment. Conventional techniques (such as panoramic radiographs) could be associated with numerous limitations such as superimposition, blurring, and distortion of anatomical structures. CBCT could be implemented as the postoperative, radiologic control approval, in order to check the position of the bony fragments, the position of the osteosynthesis plates and their relationship to surrounding areas in three dimensions.

All the images for the diagnosis, treatment planning and postoperative follow-up of this case were acquired by SCANORA® 3Dx by SOREDEX.

References:

3D Evaluation of Pharyngeal Airway Narrowing after Orthognathic Surgery: a Case Report

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Antero-posterior disharmony in the skeletal Class III condition can be a result of mandibular excess and maxillary deficiency. The surgical correction of this condition can be achieved using mandibular setback and maxillary advancement—bimaxillary surgery. The tongue, soft palate, hyoid bone, and related musculature are directly or indirectly attached to the maxilla and mandible; therefore, the dimensions of the oral cavity and pharyngeal airway space (PAS) will change depending on the skeletal positioning during surgery. Mandibular setback surgery is known to cause a narrowing of the PAS. Some authors have reported that bimaxillary surgery affected the morphology by increasing the upper part and decreasing the lower part of pharyngeal airway.

This report presents a case of pharyngeal airway narrowing after maxillary advancement and mandibular setback surgery by volume decrease in upper and lower part.

Case report

The patient, a 23-year-old female, was referred for surgical treatment of a skeletal Class III malocclusion with maxillary deficiency and mandibular prognathism. After orthodontic preparation, a bimaxillary surgical procedure was planned. Cone-beam computed tomography scan (CBCT) was obtained preoperatively using the SCANORA® 3Dx (SOREDEX) with the following parameters: 90 kV, 10 mA, 18-second scan time, and 14x16.5 cm field of view. The surgery was performed and completed without incident, and the patient was discharged from the hospital 5 days later. After 3 months, when the patient returned for a checkup, a CBCT scan was taken with same parameters. Digital image files were exported in a Digital Imaging and Communications in Medicine (DICOM) format and imported into InVivo 5.0 software (Anatomage). These images were rendered into volumetric images. Pharyngeal airway was isolated at the pre- and post-operative views, and the volume was measured between the level of the posterior nasal spine and level of the most inferior point of the soft palate (V1), and between most inferior point of the soft palate and level of the base of the epiglottis (V2). The volume of both parts of the pharynx was also measured as well as the area of maximum constriction. Preoperatively volume of whole pharynx was 10.3 cc, V1 7.8 cc, V2 2.5 cc and area of maximum constriction was 79.7 mm². Postoperatively volume of pharynx decreased significantly to 8.2 cc, V1 did not change much, it was 7.1 cc, but V2 showed greatest decrease to 1.1 cc. Already area of maximum constriction postoperatively narrowed up to 42.5 mm².

Fig 1. 3D reconstruction of pharyngeal airway preoperatively - between the level of the posterior nasal spine and level of the base of the epiglottis

Fig 2. 3D reconstruction of pharyngeal airway postoperatively - between the level of the posterior nasal spine and level of the base of the epiglottis.
Discussion
Narrowing of the PAS after orthognathic surgery has received attention in recent years. The great interest in this subject arose because a small group of patients who after surgery may develop obstructive sleep apnea (OSA). Mandibular setback surgery is known to be a cause of PAS narrowing especially at oropharyngeal level. However, after bimaxillary surgery many studies showed a decrease in the volume of the oral cavity and oropharyngeal level with an increase in nasopharyngeal level. Even more, maxillary advancement surgery has been shown to be effective in the elimination of OSA because it enlarges the PAS. Presented case could be a good example of a pharyngeal narrowing. Even though the performed surgery was bimaxillary, increase in the volume was at oropharyngeal and nasopharyngeal level and area of maximum constriction narrowed significantly. The presented case could be a patient with a high risk of developing OSA syndrome.

Conclusion
PAS in skeletal Class III deformity must be carefully evaluated before surgery and followed up after surgery to find out all changes and to prevent possible consequences. 3D reconstruction of CBCT scans can give real measurements in an easy way to diagnose postoperative changes of PAS.

References
In2Guide™ Case Report
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Patient:
Male, 32 years old, systemically healthy
Tobacco N/A, ETOH N/A, NKDA

Pre-surgery condition: Partial edentulism in region #15, #14, #46, #47. #46 and #47 had been extracted 1 year ago due to caries decay (Fig.1).

Surgery:
Following the administration of local anesthesia and mucoperiostal flap elevation, the In2Guide™ Surgical Template, fabricated via the Stone Model Scan Technique, was placed in the oral cavity. The pilot drill was performed by using the In2Guide™ Basic Surgical Kit, followed by the implant manufacturer’s protocol, two AstraTech (Friadent / Dentsply) dental implants were placed applying a two-stage protocol (Fig. 3 and 4).

Outcome:
As demonstrated in the panoramic radiograph below, the two implants have been placed according to the treatment plan, showing the liability of surgical templates. A slight divergence in the placement of the distal implant can be observed when compared to the initial treatment plan, which is owed to the use of the In2Guide™ Basic Kit, using just the pilot drill to fix the implant position. Two months after the surgery, implants will be uncovered and prosthetically restored (Fig. 4).

Fig. 1. Panoramic radiograph, pre-surgery.

Fig. 2. In2Guide module.

Fig. 3 and 4. Surgical template in situ, pilot drill.

Fig. 4. Panoramic radiograph, post surgery.

Treatment planning:
The treatment plan was to place two dental implants, delayed placement, in region 46, 47. The pre and postsurgical images were acquired by SCANORA® 3Dx, SOREDEX, Tuusula, Finland.

Due to the local anatomical situation, the implant planning was performed with the help of the In2Guide™ software module, (OnDemand3D™, Seoul, Korea), to produce a surgical template (Fig. 2).
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Competing interests:
All authors have no relevant conflicts of interest or financial conflicts to disclose. None of the authors have any relationship with the manufacturers of named companies.

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