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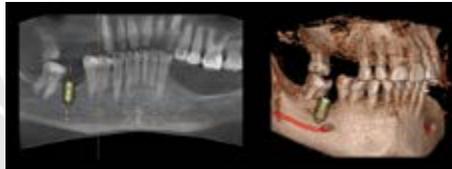
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## Editorial

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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.

Digital Dentistry, Point of Care Radiology, CAD/CAM Technologies, Biomedical Engineering are the challenges of the future, just to name a few, but scientific CBCT research and development has been finally implemented into manufacturing of 3D units – SOREDEX® is ready to offer 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 in Serbia, Tampere University Hospital in Finland, University of Banja Luka in Bosnia-Herzegovina and with a number of renowned private clinics, wipe out the dust in the brains, making the minds up for new views and punctuating the efforts to establish digital dentistry with means of scientific knowledge.

The authors of SOREDEX® Clinical Newsletters, Case Studies and other publications deserve huge respect for their work, which is not a matter of course, but also seen as an option of self-realization and motivation in the day to day clinical work.

SOREDEX® related projects are presented at many international congresses as scientific research in CBCT imaging is more and more implicated synonymously with high level education and information. SOREDEX® is proud to be able to offer you a solution to implement a scientific factor into your portfolio in the form of this clinical literature, collected and reviewed by the SOREDEX® International Editorial Board.

The first edition of the SOREDEX® booklet was launched at the 3rd SOREDEX® International 3D Workshop in September 2013 and the second and third editions published in 2014 received great interest and appreciation by their readers. By publishing these booklets, SOREDEX® succeeds to confirm its scientific status and therefore will expand these efforts also in 2015 - and boost the SOphisticated REsearch in DEntal X-ray even further.

Yours sincerely,

Mrs. Tiina Holkko, Commercial VP, Global Imaging Sales  
Dr. Jörg Mudrak, DDS, DMD

## SCANORA® 3Dx

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# Guided implant surgery - an In2Guide™ planning concept

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## Introduction

Guided implant surgery is a well-known and proved concept in the surgical treatment of edentulous patients. Main indications of guided implant surgery are complex anatomical conditions, need for minimally invasive surgery, optimization of the implant positioning in esthetically demanding cases and utilization of immediate loading concept after implant insertion.

Various concepts and planning workflows of guided surgery concepts are offered to the practice. The decision which concept should be followed should be according to the needs of the patient, but in general, the availability of the multiple system components bound our decision making. The simplicity of a system - like the In2Guide™ system (Cybermed Inc., Korea) - could lead to widespread use of guided implant surgery

## Case report

The intention of this case was to reconstruct a demanding trial case with a basic surgical guide enabling direction and depth control of the initial drill in order to meet benefits and restrictions of this technological concept. The In2Guide™ surgical guide and the basic surgical kit in combination with DIO SM submerged implant was chosen to evaluate the concept.

Our main goal was the reconstruction of an edentulous maxilla with the insertion of six implants.

### Patient history:

- 60-year-old female patient
- Osteoporosis, per oral Bisphosphonates past 9 months (Fosavance, fusion mix of Cholecalciferol and Alendronate)
- Teeth regions 17 and 27 are indicated for extraction due to endo-periodontal pathology
- Teeth lost due to caries years ago
- Intermaxillary relationship is preserved
- No inflammation or pathological changes at the oral mucosa
- Periodontal status of lower jaw: healthy

After the clinical examination and analyses of the panoramic radiograph, complex anatomic conditions could be diagnosed: impacted canine region 15-12 (FDI notation) and post extraction defect region 22-24 (FDI notation) (Fig 1, 2).



Fig.1. Clinical assessment.



Fig.2. Initial panoramic radiograph.

For the definite implant planning a CBCT recording of the patient wearing his denture was obtained (SCANORA® 3D, SOREDEX, Finland). The presence of a denture, fulfilling optimal functional and esthetic demands facilitates the implant planning. Matching of the denture's CBCT (radiographic guide) to the patient's CBCT, enables the configuration and planning according to the OnDemand3D In2Guide™ planning module (Fig. 3).

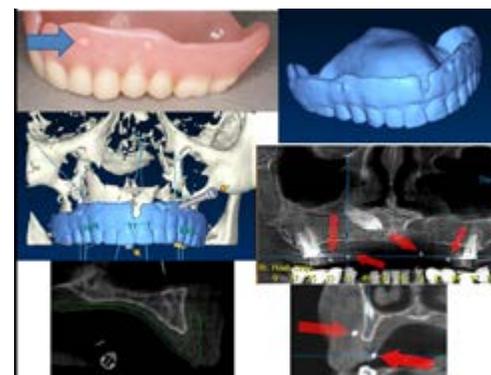
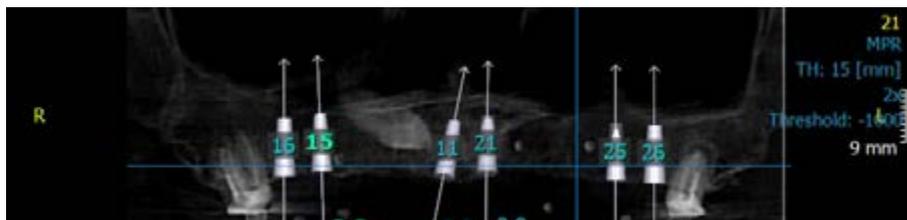


Fig.3. Radiographic guide, CBCT scan.

The implant planning was performed according to the teeth position and the available bone volume (Fig. 4).



**Fig.4.** DVR view, PAN detail, adapted implant planning.

Due to an extensive post-surgical defect in region 22-24, an impacted canine in region 12-15, the need for extraction of the remaining teeth and limited anatomical conditions, qualified six positions as suitable for an implant placement (16, 15, 11, 21, 25, 26). In all positions, signed for an implant placement, a D4 bone quality could be detected.

The patient's medical history, e.g. Bisphosphonates consumption, requested for a minimally invasive surgery. Due to these conditions, we opted for a flapless approach, leaving the impacted canine in situ.

The implant positions 16, 15, 21, 25, 26 reflect prosthetic driven planning and the implant position 11 was planned to be inclined to avoid an impingement to the impacted canine and the palatine canal.

The surgical guide was designed to be tissue borne in order to perform a flapless implant surgery. Due to the present bone quality (soft bone, D4), the limited number and the uncharacteristic positions of the planned implants, we decided not to opt for an immediate loading protocol, but to adapt the existing prosthesis as a removable provisional.

The final implant planning was processed by the In2Guide™ module of the OnDemand3D™ application software (Cybermed, Korea), the digital plan was then sent electronically to the manufacturer and the surgical guide was produced.

The patient was preoperative medicated with 2 gr Penicillin per os. The operating field was prepared by rinsing the oral cavity for 2 min with chlorhexidine solution (0.12%) and a subsequent cleaning extraoral and intraoral with an iodine solution. The surgery started with the fixation of the surgical guide with two 2.0 mm anchor pins (In2 Guide™ Basic surgical kit) positioned at the right palatine side and the left vestibular side (Fig. 5).



**Fig.5.** Surgical guide, anchor pins.

After the guide fixation, an initial drilling with the 2.0 mm pilot drill (In2 Guide Basic surgical kit) was performed (Fig. 6).



**Fig.6.** Pilot drill.

During the initial drilling we detected a light resistance, which in combination to a D4 bone quality (CBCT analyses, In2Guide™ module) promoted us to go for an undersized preparation of the implant bed. Following the initial drilling at all anatomic positions, the surgical guide was removed. A manual tissue punch (3.2 mm diameter) was performed, centering punch marks to the initial drilling marks. The surgical protocol was continued with the standard surgical implant drill set (SM/SM Int. Master, DIO, Korea).

A profile bur, transferring the 2.0 mm to the 2.7 mm drill, eased the preparation and enhanced the precise direction control, defined by the surgical guide. All implant beds were prepared undersized to one preceding diameter. Drill stops, fixed on the final drill enabled a secure depth control. As the surgical drilling protocol was finalized, the implants were (SM submerged, DIO, Korea) inserted in the planned anatomic positions (Fig. 7, 8).

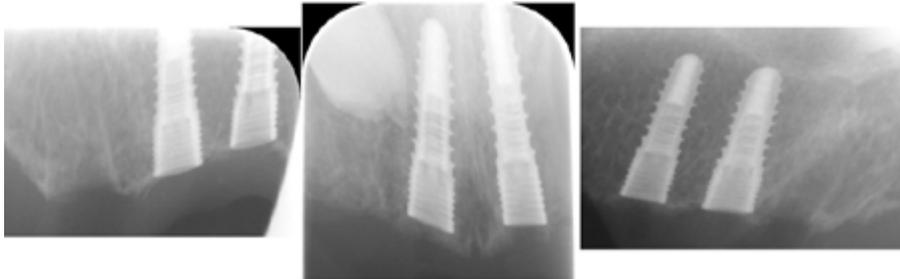


**Fig.7.** Drill stop bur in situ.



**Fig.8.** Clinical outcome, rad control.

The last depth control was performed by a dental X-ray (Fig. 9)



**Fig.9.** Intraoral, depth control.

Wide diameter healing abutments (5.2 mm diameter) were chosen to exert the pressure to the surrounding mucosa to control soft tissue bleedings. The patient was instructed to rest, maintaining oral hygiene and soft food diet. The treatment will be continued after an approximately 6 months' healing period, follow-up appointments were agreed.

## Conclusion

The combination of CBCT imaging and guided implant surgery enables the surgeon to increase the surgical level and result, even in difficult, special indications presented in this report. Nevertheless, a profound radiological and surgical education is the basis and the prerequisite for any successful surgical operation.

## References

M. Davarpanah, S. Smukler-Moncler. Unconventional Implant Placement. Placement of Implants Through Impacted Teeth. The International Journal Of Periodontics & Restorative Dentistry, 2009, p 405-412.

## Editor's comments:

Bone quality:

Type DI: homogeneous cortical bone

Type DII: thick cortical bone with marrow cavity

Type DIII: thin cortical bone with dense trabecular bone of good strength

Type DIV: very thin cortical bone with low density trabecular bone of poor strength.

# Diagnosis and management of a rare case of a maxillary second molar with two palatal roots, supported by conventional radiography and cone-beam computed tomography

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(This work was presented at the XVI Congress of the European Society of Endodontology, Lisbon, 2013)

## Introduction

Besides adequate knowledge about root canal morphology in general, it is of utmost importance to evaluate each individual case for aberrant anatomy and to identify any morphological variation before and during an endodontic procedure of such teeth. In the clinical practice, conventional radiography with the assistance of an operating microscope is the most common method to evaluate root canal anatomy. However, it has been shown that their use does not result in revealing all anatomical details. Recently introduced and developed cone-beam computed tomography (CBCT) for dental use has proved to be more accurate in detecting root canal morphology, especially in maxillary lateral teeth. One of the most unusual and rare aberrations of tooth anatomy is the maxillary second molar with two separated palatal roots. A relevant patient appeared at the Department of Endodontics only ten years after the preceding relevant patient was recorded.

## Case report

A 26-year-old male patient sought for treatment at the Department of Endodontics, University School of Dental Medicine, Belgrade, with the following major complaints:

- a) spontaneous dull, mild and intermittent pain in the region of the left upper molar
- b) moderate sensation of pain when biting hard food
- c) symptoms had lasted already for a couple of weeks.

Additional information was acquired from further anamnesis:

- a) there were no other symptoms, and no irradiation of existing pain
- b) patient recalled that a root canal therapy had been conducted at the very tooth for a couple of years ago
- c) he also recalled that two teeth on the same side of the upper jaw had been extracted, at least ten years ago.

Furthermore, clinical examination confirmed:

- a) of total three molars, only the second molar, 27, with an extensive amalgam restoration, was present on the left side of maxilla
- b) moderate sensitivity on vertical percussion of the buccal cusps, painful reaction on the percussion of the mesio-palatal cusp
- c) neither on vestibular nor on palatal side sensitivity on digital palpation
- d) both hot-cold and electric vitality tests were negative
- e) no pathologic mobility of the tooth.

The diagnostic periapical radiograph (bisecting angle technique) revealed:

- a) partly obdurate palatal and mesio-buccal (MB) canal, unfilled disto-buccal (DB) canal;
- b) slight radiolucency around the palatal root apex, no distinctive border towards the surrounding maxillary bone structure.

The necessity of an endodontic retreatment of the tooth was explained in detail to the patient, who accepted the suggested therapeutic procedure and the general schedule for further appointments.

## Treatment procedure

The old amalgam restoration and the phosphate cement base were completely removed, cavity walls were additionally prepared to enable a clear visibility and straight line access to all root canal orifices. The orifices of the palatal and mesio-buccal (MB) root canals had been blocked with obturation material, presumably iodine-phosphate cement and a gutta-percha cone. Approximately 3 mm distally from the orifice of the obturated palatal root canal, another oval, crack-like orifice could be seen, appearing like a perforation. Further assessment of the pulp chamber floor was performed by assistance of the 4.5 x magnifying loops and the Endodontic Probe Orifice Opener (Dentsply/Maillefer, Ballaigues, Switzerland). Using the probe and K-file # 10 to negotiate through the flat oval orifice, the presence of a second, disto-palatal (DP) root canal was detected and approved.

The orifice of the disto-buccal (DB) root canal was hidden with brownish deposits of tertiary dentine, located about 2 mm distally from the obturated mesio-buccal orifice, and approximately 2 mm buccally from the orifice of the disto-palatal canal. The orifice was negotiated and slightly widened with the Orifice Opener, ensuring to be easily detected in a further procedure. The second mesio-buccal (MB2) canal could not be found in spite of meticulous searching under loops and the application of a decalcifying solution (17% EDTA).

After a related consultation and the received approval of the patient, the whole procedure was decided to be conducted in at least two sessions. At first, the root

filling material from the mesio-buccal (MB) and mesio-palatal (MP) root canal was removed by using rotating Ni-Ti files for disobturation, ProTaper D1, D2, D3 (Dentsply/Maillefer, Ballaigues, Switzerland), and manual H-files (Dentsply/Maillefer). A further instrumentation of those canals was conducted by using WaveOne files with reciprocating motions: MP with black (#40) and MB with red (#25). The working length was determined and checked throughout the whole procedure using an electronic apex locator, (EAL) Romiapex, A-15 (Romidan Ltd, Kiryat Ono, Israel).

The disto-palatal (DP) canal was then negotiated and a glide path was achieved approximately 1-1.5 mm shy of the apical foramen, using K-files size #10 and #15. The coronal portion was flared successively with Gates #3 and 2#. The same procedure was performed at the DB root canal. A clear visibility and a straight line access was arranged to all four canals (Fig. 1).

Two intraoral radiographs with an inserted K-file in each canal from two different horizontal angles were acquired, but only one revealed all four root canals (Fig. 2), showing vague contours of the apical portion of the roots.



**Fig. 1** Straight line access to all four root canals 27. **Fig. 2** Intraoral, indicating all four root canals 27.

A calcium hydroxide dressing was applied at the MP, and a paper point, soaked with 2% solution of CHX (R4, Septodont, France), was left in the MB root canal. A cotton pallet with CHX was left in the pulp chamber and the cavity was then sealed with temporary filling material.

In the second session, two weeks later, the DP and DB root canals were carefully arranged applying the same WaveOne technique as applied at MP and MB canals – the DP with WaveOne black (#40), and the DB with WaveOne red (#25). The working length was determined and checked using the same EAL Romiapex A-15 device.

2.2% sodium hypochlorite and 10% citric acid solutions were used as irritants, successively, throughout the whole endodontic procedure in all four root canals.

Each of the four root canals was finally irrigated with 40 ml of a 2.2% NaOCl solution, dried and obturated by using Acroseal (VDW, Munich, Germany) and a single gutta-percha cone with an adequate taper (Dentsply/Maillefer) (Fig. 3).

An intraoral, retroalveolar radiograph, which was acquired post treatment, was of relatively poor quality due to superimposing and interfering with the infrazygomatic arch and adjacent bone structures, particularly lacking to reveal the most important apical portions of roots with the correct root canal fillings (Fig. 4).

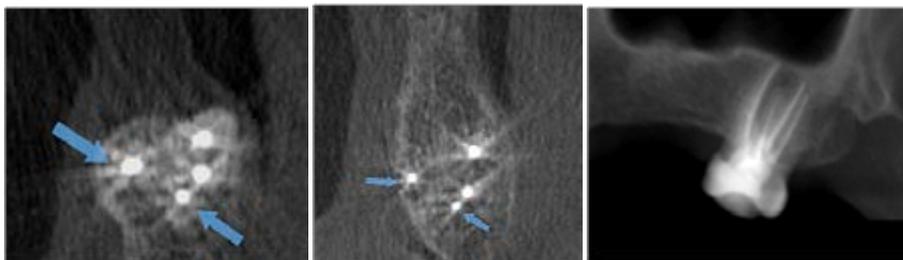


**Fig. 3** Obturated root canal orifices 27.

**Fig. 4** Intraoral, lacking periapical information 27.

In agreement with the patient, a cone-beam computed tomography was acquired, primary to check the treatment outcome, but also to document this extremely rare case with much more accurate and reliable images. The small field of view (50x50mm) was recommended, and the data was acquired by SCANORA® 3Dx (SOREDEX Oy, Finland) immediately after the treatment and at six months' recall.

The edited images (OnDemand3D™, Cybermed, Korea) clearly visualized two distinctive palatal roots, their relation to the two buccal roots, the adjacent anatomic structures - and most importantly, the quality of the obturation of all four root canals (Fig. 5-10, arrows).



**Fig. 5-7** Axial view middle level, axial view apical level, sagittal detail view tooth 27.



**Fig. 8-10** PAN detail, VR rendered view, MPR view of treatment checkout 27.

### Conclusion and key learning points

- A careful assessment of the internal anatomy of the pulp chamber is essential for detecting all root canals.
- A maxillary second molar with two separate palatal roots is a rare anatomical variation and, according to our records, is detected only once in a decade.
- CBCT images provide more accurate and reliable information of roots and the root canal morphology than conventional radiographs are able to provide, and concerning the treatment outcome, CBCT images enable a much more predictable and successful endodontic treatment procedure.

## Osteomyelitis as a complication of an acute periodontal abscess

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### Introduction

All periodontal conditions can be easily recognized according to their representative clinical appearance.

Abscessus periodontalis is a localized, purulent infection within the tissues adjacent to the periodontal pocket that may lead to the destruction of the periodontal ligament and the alveolar bone.

An acute periodontal abscess represents one of the most common periodontal emergencies in the dental field. There are several etiologies for the formation of a periodontal abscess. The diagnosis of a periodontal abscess is determined in most of the cases by clinical examination.

A periodontitis-related abscess usually occurs as an acute exacerbation of an untreated chronic periodontitis or as a consequence, complication of a treatment of a chronic periodontitis.

Otherwise, non-periodontitis related abscesses emerge due to foreign body impaction or due to alterations in the integrity of the root surface, causing a bacterial colonization. In case of recurrent abscesses, the following differential diagnoses should be considered: osteomyelitis, squamous cell carcinoma and eosinophilic granuloma.

The primary characteristics of a periodontitis are marginal inflammation, periodontal pocket formation and attachment loss and the alveolar bone loss. Panoramic radiographs are the first choice in the radiologic hierarchy of diagnostic imaging tools, however, panoramic radiographic evaluations tend to underestimate the real incidence of bone loss. In some cases, an alternative imaging modality is essential for accurate diagnosis.

This case report demonstrates that CBCT imaging can provide key information of relevance in periodontal diagnoses, which cannot be obtained by extraoral, intraoral or periapical 2D radiographs or any clinical examination.

## Case report

A 30-year-old systemically healthy woman was referred to our clinic by her dentist with the probable diagnoses of periodontal abscess.

The patient suffered from a subtle pain and tenderness in the palatal area surrounding the left first maxillary molar. The intraoral examination revealed a diffuse swelling of the palatal gingiva surrounding the second premolar and first molar, soft on palpation and clear signs of inflammation.

The involved teeth showed no mobility, moderate plaque accumulation, bleeding upon probing and they reacted positively in repeated vitality tests. The patient's periodontal examination revealed a good periodontal health. Just one periodontal pocket, with 11 mm's depth and with suppuration, could be detected in the mesial palatal aspect of the first left maxillary molar. The regional lymph nodes were palpable and slightly painful.

As a first treatment option a drainage via the pocket lumen was established and a subgingival instrumental cleaning of the root surface was performed.

One month later, the patient returned to our clinic and reported a painless feeling of a kind of foreign body, present in the previously affected area. The clinical periodontal examination of the maxillary left first molar showed no pocket mesio-labial and a 6 mm pocket mesio-palatal. The palatal mucosa and gingiva showed no signs of an edema or inflammation.

The tooth showed no evidence of a fracture and was not tender on the percussion test. There was no mobility. Lymph nodes were not palpable. The acquired periapical radiograph of the region of interest revealed a discreet and not well defined alveolar bone rarefaction in reg 25, 26 (Fig. 1).



**Fig. 1** Periapical rad reg 25, 26.

In order to obtain more clinical information, the patient was sent to the Centre for Radiological Diagnostics, School of Dental Medicine, University of Belgrade to acquire a CBCT scan.

The CBCT scan was performed by SCANORA® 3Dx, (SOREDEX, Finland). A series of cross-sectional 1 mm images, based on the CBCT data was created (OnDemand3D™, Cybermed, Korea) visualizing areas of extensive bone loss in close proximity to the first left maxillary molar, and the presence of a sequester (Fig. 2, 2a, arrows).



**Fig. 2** MPR view, bone loss and sequester reg 25, 26.



**Fig. 2a**, MPR VR - zoom sequester reg 25,26.

A bland maxillary sinusitis and a muco-periosteal thickening as a sign of a long-term inflammation, could be revealed (Fig. 3, arrow).



**Fig. 3** MPR, coronal view, muco-periosteal thickening.

## Therapy

The sequester was removed in local anesthesia by periodontal curettage and a histopathological analysis of the specimen was performed. The diagnosis was in compliance with a bland osteomyelitis.

The patient was released after surgery and recall appointments were scheduled for every third day in the next two weeks. The clinical examination at the two-month follow-up indicated an incomplete recovery of the soft tissue, but no signs of inflammation.

## Conclusion

According to the fact that the patient was in a good general periodontal health, it can be concluded that the osteomyelitis developed as a complication of the acute periodontal abscess. The clinical presentation of an acute periodontal abscess, swelling and suppuration in the affected area could have swapped the signs of an osteomyelitis from the beginning. It is notable that deep, strong pain, which is a hallmark of an osteomyelitis, was absent.

The present report emphasizes the need of appropriate imaging technique to diagnose the pathological conditions of the periodontium. It also highlights that CBCT technology has great advantages as a diagnostic tool in the everyday dental practice.

## Does a preoperatively acquired CBCT image influence the planning and choice of surgical technique in removal of impacted third molars of the lower jaw?

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### Introduction

The surgical removal of impacted wisdom teeth is, beside apicoectomy, the most common oral surgical procedure accompanied by intra- and postoperative complications<sup>[1]</sup>.

These complications include damage to the soft and hard tissues of tooth alveoli, and another and more severe complication is a temporary or permanent disturbance of the inferior alveolar and the lingual nerve. The clinical consequences of this complication can be numbness in the region of its innervation, swelling, pain, limited mouth opening, injuries of the tongue and lips caused by biting when ingesting. These complications may sometimes last for several weeks<sup>[2]</sup>.

A well prepared surgical planning should be performed well ahead of the scheduled surgery, primarily to reduce the surgical risk to a minimum and to ensure a normal postoperative healing procedure. The overall incidence to damage the inferior alveolar nerve is more than 19%, if there is a close proximity of the third molar's roots to the inferior alveolar nerve.

Some studies have shown that the percentage and level of complications is directly related to the degree of difficulty of the surgical removal and the degree of tissue damages caused during the surgical procedure<sup>[3-4]</sup>.

In rare cases those complications occur, various options to reduce the severity have been suggested and performed, like the use of ice packs, medication of antibiotics<sup>[5]</sup>, corticosteroids<sup>[6]</sup>, magnets, etc.

The use of slow rotating burs when removing an impacted lower 3rd molar could also reduce the overheating of the bone<sup>[7]</sup> and avoid intrabony inflammation or, in the worst case scenario, an idiopathic caused osteomyelitis.

A lot of data has been obtained of several histological and histomorphometric studies performed at animals in applying ultrasonic devices as a surgical tool, replacing the standard surgical protocol for osteotomy<sup>[8-10]</sup>. The minimal invasive

Piezosurgery® method has already proven to be very effective in preserving bone and soft tissue integrity<sup>[11]</sup>, in contrast to the standard instrumentation, which is much more invasive.

The goal of this study is to present the benefits of a CBCT planned removal of lower 3rd molars and the surplus of the exact determination of the anatomic location in the mandible using this technology.

CBCT scans enable the surgeon to estimate the relationship of an impacted tooth to the inferior alveolar nerve, the morphology of the roots and alveolar conditions, and also to decide which kind of surgical technique is adequate to apply to avoid intra – and postoperative complications compared to standard methods of surgical removal of impacted third molars in lower jaw.

### Case Report

A patient, 30 years of age, responded to a survey of the clinic concerning problems that occurred after removal of impacted lower left third molar in private practice, manifested with severe pain, trismus (lockjaw), inconvenient halitosis and numbness of the left side of the lower lip and the tongue.

The medical history of the patient stated that the intervention was very painful and was completed in an average time of 90 minutes. The surgeon used conventional surgical technique (drill, pliers).

Following a specific clinical examination of the patient documenting the level of pain and the degree and area of numbness of the lower lip by using a visual analog pain scale (Fig. 1), the patient was referred to acquire a CBCT scan (CRANEX® 3D, SOREDEX, Finland) to evaluate the postoperative status of the operational field radiologically.

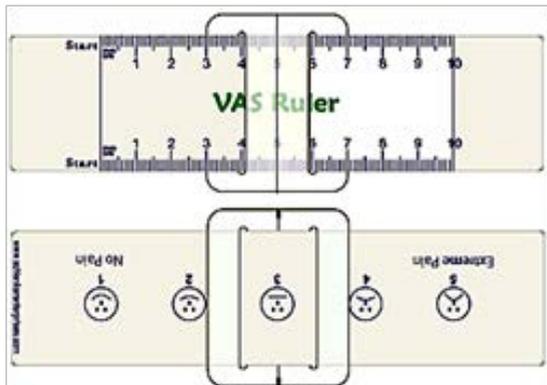


Fig.1 Analog pain scale.

This recording was also observed to evaluate the degree of destruction of the lingual cortical alveoli and status after tooth extraction (Fig. 2 and 3). Images were edited (OnDemand3D™, Cybermed, Korea) and adjusted accordingly.

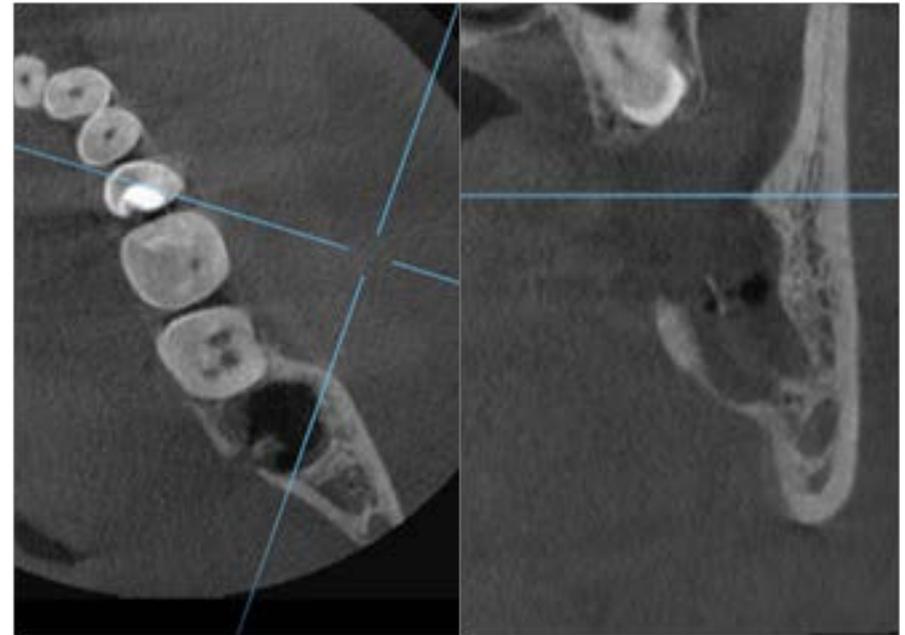


Fig. 2, 3 Axial, cross sectional view, destruction of the lingual cortical alveoli.

Due to the diagnoses the patient was conducted to a surgical-conservative therapy: removal of the remains of a blood clot in the alveoli, rinsing the operating field with saline and placing an acetylsalicylic acid swap. The patient was medicated seven days with antibiotic therapy.

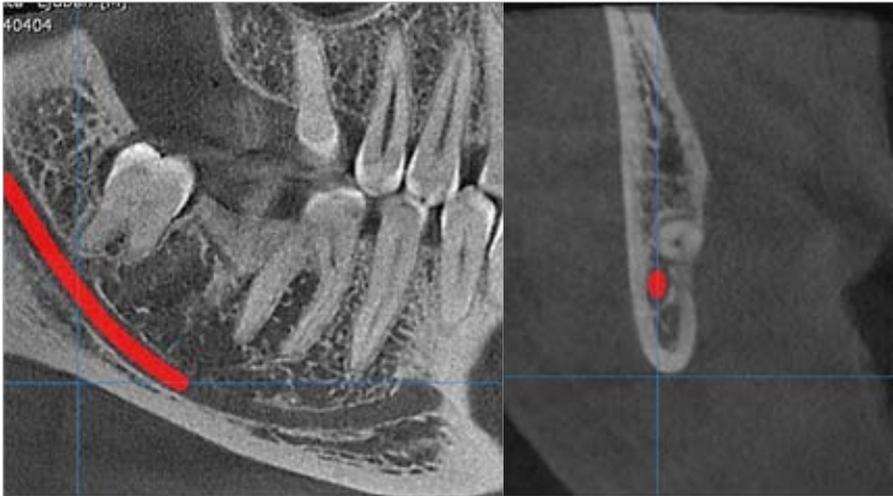
After the cessation of pain, a radiograph was acquired to plan and schedule the removal of the lower right 3rd molar, adapting Kim's classification of the CBCT determined position of the lower right wisdom tooth. Surgery was performed using the Piezosurgery® technique.

The patient suffered pain for approximately 12 hours postoperative and a sense of numbness of the lower lip was not stated.

## Radiographic evaluation

Kim is the radiologic analysis of the relation between the roots of lower 3rd molars and the mandibular canal.

The degree of impaction and five characters complement one another: darkening roots, roots flex, narrowing roots, dark and incompletely developed roots and a narrow mandibular canal lumen are correlating to the degree of neuro-sensorial deficits of the inferior alveolar nerve after surgical removal of lower wisdom teeth in general (Fig. 4 and 5).



**Fig. 4.5** DVR view, PAN detail, cross-sectional view, tooth 48.

Transforming the information obtained by the CBCT scans to KIM's categorization, we opted for the Piezosurgery® technique in removing impacted lower 3rd molars

## Surgery

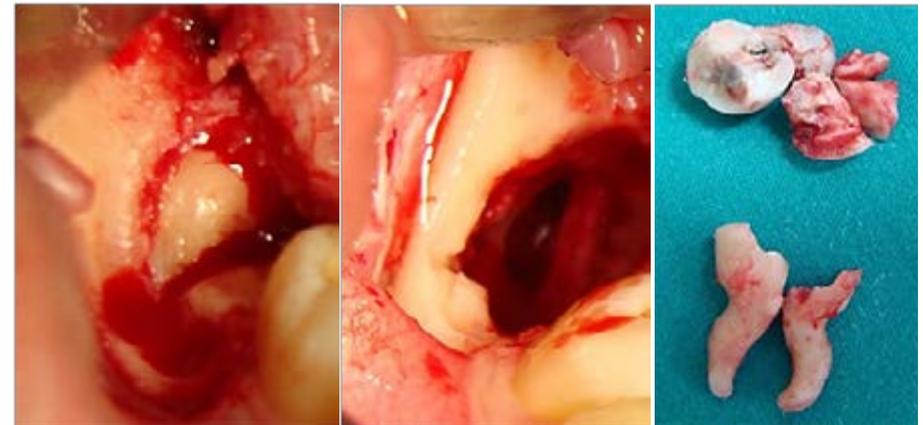
Surgery for all similar patients was performed according to our standard protocols, the operational field was locally (N alveolaris inferior) anesthetized with 2% Lidocaine (1:100000) at the beginning of the surgical intervention. The surgical access to the operating field was gained by a mucoperiosteal incision and raising of a full mucoperiosteal flap.

The access to the crown of impacted teeth can be achieved with minimal removal of the surrounding bone, the crown is then separated from the rest of the teeth. The same technique is applied for the separation of roots. This approach and technique does not jeopardize adjacent anatomic structures and minimizes the surgical trauma.

## Results and Discussion

A detailed preoperative analyses of the degree of difficulties of impacted lower 3rd molars is of high importance. [12-16]

If the CBCT data analyses shows characteristics of Kim's categorization of impacted lower 3rd molars, the surgical protocol should offer the option to use the Piezosurgical® technique when separating tooth structures. Hard and soft tissue could be preserved and a damage of nervous structures could be avoided, as well as invasive neurosurgical interventions. Postoperative complications are reduced to a minimum and the healing period is shortened, increasing the patient's compliance and confidence. (Fig. 6,7 and 8). Figure 7 shows the bare, but preserved inferior alveolar nerve.



**Fig. 6**

**Fig. 7**

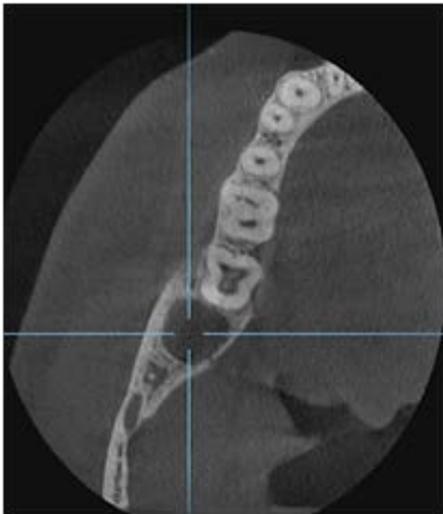
**Fig. 8**

**Fig. 6** Operating field of a lower 3rd molar.

**Fig. 7** Bare, preserved inferior alveolar nerve.

**Fig. 8** Separated, removed 3rd molar.

The postoperative analysis of the CBCT data did not show any significant alteration of adjacent anatomic structures (Fig. 9), the clinical examination was without any pathologic findings. The patient was comfortable and the time of convalescence was short.



**Fig. 9** Axial view, postop control.

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## CBCT as accurate tool for the treatment planning of patients with BRONJ

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

In 2003, Marx described non-healing and painful exposure of jaw bones, following an intravenous administration of potent aminobisphosphonates in patients suffering from multiple myeloma and metastatic bone lesions. Soon this adverse effect was named Bisphosphonate-Related Osteonecrosis of the Jaw (BRONJ), or drug-induced osteonecrosis of the jaw. According to AAOMS, the definition of BRONJ means:

1. Current or previous treatment with bisphosphonates .
2. Exposed bone in the maxillofacial region that has persisted for more than 8 weeks.
3. No history of radiation therapy to the jaws.

### Case report

We present a 55-year-old female patient, who developed BRONJ of the right upper jaw following a teeth extraction (teeth 13 and 14). Due to her severe osteoporosis she was under bisphosphonate therapy (Alendronate 70 mg once "per os" weekly) for the last four years. She also suffered from a confirmed diagnosis of COPD (chronic obstructive pulmonary disease).

Following the clinical examination, the exposed bone in the right maxilla could be clinically identified (Fig. 1). In order to treat BRONJ accordingly, there was a need to define the accurate stage of the disease, because the treatment approach highly depends on the determination of the stage. The orthopantomographic image, which was performed, could not clearly visualize any bone sequestration (Fig. 2).



Fig. 1 Exposed bone, right maxilla.



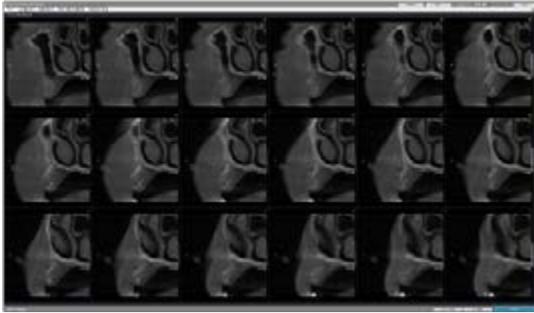
Fig. 2 Panoramic X-ray, no clear signs of bone sequestration in the right maxilla.

According to AAOMS classification of the disease, a sequestration of bone is a clinical sign for stage 3 of BRONJ and requires a surgical debridement – the removal of bone sequester. A misdiagnosed sequestration of bone could lead to wrong treatment planning and head in the progression of the disease.

In order to improve the preoperative stage and to perform an adequate treatment plan, a CBCT (SCANORA® 3Dx, Finland) was acquired (Fig. 3 and 3a)

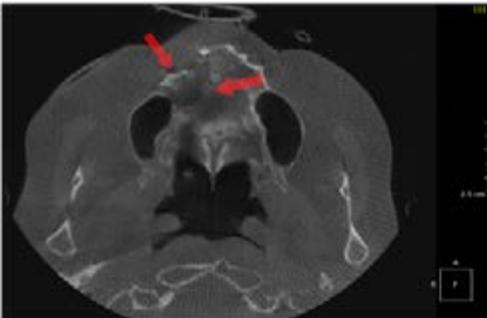


Fig. 3 Panoramic view, showing a clear zone of bone sequestration in the right maxilla (red arrow).



**Fig. 3a** Cross-sectional view of the area of sequestration.

The axial and sagittal views of the CBCT confirmed our findings (Fig. 4 and 4a).



**Fig. 4** Axial view.

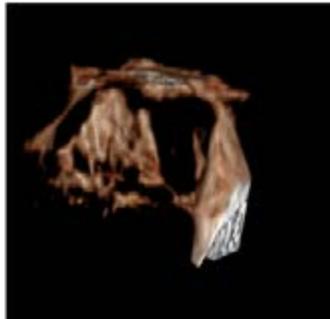


**Fig. 4a** Sagittal view, right maxilla visualizing the centre of the sequestration and the peripheral radiolucency (red arrows).

To visualize specific bone structures, a rendered view was made in the image editing software (OnDemand3D™, Cybermed, Korea), and it revealed the detailed information needed. By using the 3D zoom tool, it is very easy to eliminate other structures, which could interfere with the region of interest (ROI) (Fig. 5 and 5a).



**Fig. 5** Rendered view, region of bone sequestration, hyperdense object distal of the ROI



**Fig. 5a** Zoom of the ROI.

It was very important to avoid a superimposition of other bony structures. By acquiring a CBCT, as the sophisticated technology in radiologic diagnostics, we could exactly predict the stage of the bone sequestration in the right maxilla. According to the radiological findings we performed a surgical sequestrectomy (Fig. 6 and 6a).



**Fig. 6** Surgical sequestrectomy, right maxilla.



**Fig. 6a** Specimen, sequester.

The defect recovered completely within 10 days, showing no signs of a disease relapse in 6 months postoperatively.

### Conclusions

BRONJ is a serious negative side effect of a bisphosphonate therapy that impacts negatively on the patients' quality of life. It is painful, non-healing and often without any adequate response to the applied therapy.

Due to its versatility in imaging, resolution and the possibility to predict bony lesions with high accuracy, CBCT technology could be of great importance in the treatment of BRONJ patients in the future.

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