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CBCT: Is dentistry ready for a new standard of care?  

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CBCT in assessment of the anatomic relations  

| **meetings**  
EAO 2014—Simplifying dental implant treatment
Dental Tribune International
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It is that time of the year again: everyone is getting ready to close out 2014 and usher in the new year. It is always informative to review the events of the past year and to speculate on what the future will bring. The march of high technology continues with the various gadgets that appear just in time for holiday gifts. The more high-tech, the more desirable and sought after, and it appears that nothing is safe from the incorporation of digital data in some form.

While not entirely new, the concept of wearable technology has blossomed into a multibillion-dollar industry during the past few years. In fact, there is an upcoming Wearable Tech Expo in New York on 2–4 June 2015. Dr. Shawn DuBravac, Chief Economist and Senior Director of Research for the Consumer Electronics Association, has stated that we need to harness wearable data because “the union of wearable technology and health care has the potential to address the trifecta of issues burdening the US health care system: rising costs, lack of coordination in providing care, and the increase in chronic diseases tied to lifestyle.” We now have digital smart bands and watches, like the soon-to-be-released Apple Watch and the Samsung Gear S, which can not only tell time, but also monitor your heart rate, count your steps, tell you how many floors you have climbed, and detect changes in elevation when linked to your smartphone—all in the name of keeping us physically fit.

One area that is relevant to readers of Cone Beam International magazine of Cone Beam Dentistry is the ability of smart bands to measure sleep patterns. Gadgets like Sony’s SmartBand, Microsoft Band and Jawbone’s UP3 are selling worldwide, and some claim to be capable of distinguishing between REM, light and deep sleep. Chris Haslam of Wearable (www.wearable.com) states that “virtually every fitness tracker has the ability to map your shut-eye. They work by continuously monitoring your movements during sleep—known in professional sleep circles as Actigraphy—and assessing sleep-wake cycles to see whether you’re in deep or light sleep.” These devices also show you a graph of your sleep patterns on an application on your smartphone. There are even trackers that can use your phone’s microphone to record sleep noises, like snoring, to explain why you may wake up several times each night. He states that “while not as accurate as professional sleep monitoring equipment, or lab tests, fitness bands can help paint a clearer picture of your own sleep cycles.”

Within the dentist’s scope of care is the potential to diagnose and treat patients who exhibit sleep problems and specifically sleep apnoea in its various forms. CBCT data as interpreted through sophisticated software applications may be our digital link to accurate diagnosis and treatment of these sleep disorders. Airway analysis has become a hot topic at CBCT-related symposia—which prompted the composite artwork for this issue’s cover. In a recent article, Alsufyani et al. conducted a systematic review of the use of CBCT to assess upper airway changes and treatment outcomes of obstructive sleep apnoea. The article concluded that “the available published studies show evidence of CBCT measured anatomic airway changes with surgery and dental appliance treatment for OSA. There is insufficient literature pertaining to the use of CBCT to assess treatment outcomes to reach a conclusion. High-quality evidence-level studies, with statistically appropriate sample sizes and cross validated clinically, are needed to determine if CBCT airway dimensional changes are suitable for assessment of treatment outcome.” More study is needed, of course, but clearly evidence is mounting that CBCT will play a vital role in the assessment and treatment of sleep disorders.

Perhaps we will soon be linking the digital data from wearable tech-savvy smart bands provided to our patients as we monitor the airway space with our CBCT data. Just another amazing link between the incredible data afforded to us through our CBCT devices and another potential means to help our patients. Continue to witness our digital evolution that will affect our lives in 2015 and beyond by following the many informative articles contained within the covers of the latest issue of Cone Beam International magazine of Cone Beam Dentistry.

Respectfully,

Dr. Scott D. Ganz, Editor-in-Chief

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Since its commercial introduction into dentistry in 2001, cone beam computed tomography (CBCT) has been rapidly evolving into a new standard of care in maxillofacial imaging. In just over a decade, CBCT has exploded onto the dental landscape and permitted dental professionals a degree of three-dimensional (3-D) anatomic truth in maxillofacial imaging previously unavailable and unattainable. Like many other new technologies, which have progressed from the extraordinary to the ordinary and thus gained acceptance by professionals and patients, CBCT has advanced from exceptional use to almost commonplace use in dentistry as cost decreases, access to the technology increases, and potential adverse patient interaction (i.e. radiation exposure) is attenuated. Today, CBCT is seen by many in dentistry as the standard operating procedure for many dental implant, orthognathic, orthodontic, or endodontic cases.

CBCT has also been recognised by general dentists and specialists as a means by which they can separate, identify, and distinguish their practices as being on the vanguard of technology in patient care. Today’s patients expect their dentist and physicians to be contemporary with technology and services. CBCT provides the doctor with a technology, which not only has significant advantages in treating patients but also has a noteworthy “wow” factor as the 3-D images are seen on a large screen in “real time” for the doctor and patient to view.

CBCT, like plain film radiographic studies, may be considered a revenue generator for a practice. The more a CBCT machine is utilised, the more revenue it will generate. Additionally, the owner may allow others in the profession to utilise the machine for a fee, thereby reducing his overall cost of operation.

Standard of care is a legal not a medical or dental concept. Standards of care are constantly evolving as methods and techniques in patient care improve. An appropriate definition for standard of care may include such language as: the dentist is under duty to use that degree of skill and care which is expected of a reasonably competent and prudent dentist under the same or similar circumstances. Standards of care may be local, regional or national.
Standard of care influences

The influence of an emerging technology, like CBCT, into a new standard of care involves many criteria. These criteria include but are not limited to: court verdicts, expert testimony, literature support, professional guidelines, cost and availability of the technology, reimbursement by third party payers, and multi-specialty use and recognition.

Taken individually, these criteria do not constitute a mandate for any technology as a standard of care. Nor are these the only criteria one may use in determining standard of care. Taken together, these criteria provide strong evidence that CBCT technology has sufficiently evolved to be considered the standard of care in maxillofacial imaging in selected cases to assist the dentist in treatment for patients in need of dental implants, orthognathic surgery, manipulation of difficult impacted teeth, orthodontics, endodontics, and many other facets of dentistry.

The legal perspective

The legal system in the United States is complex and fragmented. No database exists to search verdicts in dental malpractice cases in which CBCT has played an important or pivotal role. For a new technology to become admissible as a standard of care in court, it must pass the Frey test. This standard comes from Frey v. United States which is a 1923 in a case discussing the admissibility of a polygraph test as evidence. The Frey standard maintains that scientific evidence presented to the court must be interpreted by the court as “generally accepted” and expert testimony must be based on scientific methods that are sufficiently established and accepted.

In Frey, the court opined: “Just when a scientific principle or discovery crosses the line between the experimental and demonstrable stages is difficult to define. Somewhere in this twilight zone the evidential force of the principle must be recognised, and while the courts will go a long way in admitting experimental testimony deduced from a well-recognised scientific principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs.”

In many jurisdictions and in Federal court, the Frey standard is superseded by the Daubert standard. The Daubert standard is used by a trial judge to make a preliminary assessment of whether an expert’s scientific testimony is based on reasoning or methodology that is scientifically valid and can properly be applied to the facts at issue. Under this standard, the factors that may be considered in determining whether the methodology is valid are:

- theory or technique in question can be and has been tested,
- it has been subjected to peer review and publication,
- there is a known or potential error rate,
- the existence of maintenance standards controlling its operation,
- widespread acceptance within a relevant scientific community.

The theory or technique behind medical grade computed tomography and CBCT has been tested and proven sound over many years of application in the medical and dental arena. The Hounsfield unit is the widely recognised standard quantitative scale for describing radiodensity and provides doctors with a known standard and error rate in computed tomography. The widespread acceptance of CBCT by the medical and dental community is demonstrated by the ever increasing presence in dental and medical practices of the technology. Additionally, The Intersocietal Accreditation Commission, an accreditation organisation for medical and dental imaging, has developed guidelines and accreditation criteria for 3-D CBCT imaging. Thus CBCT appears to have satisfied both the Frey and Daubet criteria for acceptance as a standard of care technology.

Not to discount the value of CBCT imaging or its ability to successfully satisfy the Frey or Daubet criteria, the absence of CBCT is not de facto evidence of lack of a standard of care imaging. Many patients present to their dentist with uncomplicated cases where traditional two-dimensional radiographic studies are appropriate and provide the dentist with standard of care imaging of the patient. For the more complicated cases, 3-D imaging may be employed to provide the dentist with superior anatomic evidence in treatment planning and diagnosis. Three-dimensional imaging with CBCT can also be used in uncomplicated cases, but it may not necessarily be considered as the standard of care for every case in 2014.

Expert Testimony

An expert is a person with sufficient minimal qualifications to render an opinion on the subject at hand. Not all experts are created equal, and in fact in three states (Iowa, South Dakota, and New Hampshire) an expert need only be qualified in a related field to offer an opinion. Experts are used by the courts to educate the judge and jury as to what constitutes normal minimal acceptable care of a patient in a given environment.
Expert testimony is by definition the opinion of one practitioner. It is an opinion based on fact, evidence, experience, and knowledge which the expert believes to be relevant, valid, and upheld in the scientific community.

When reviewing a case for suspected malpractice the expert examines many things, including, but not limited to: chart notes, radiographic studies, depositions, and professional correspondences. In the last five years, the author has noticed a remarkable increase in the number of cases in which plaintiffs and defence attorneys, as well as experts, rely on pre and/or post-procedure CBCT imaging studies to assist in proving malpractice or defending good practice. Post-treatment radiographic imaging to prove malpractice or support good practice is not new to medicine. In fact in the years preceding WWI, some of the highest malpractice claims were awarded in cases where post-treatment radiographs played a pivotal role.

Logic would dictate that if plaintiffs and defence counsels and experts are making CBCT part of their strategy, then CBCT must be not only prevalent and pertinent but of significant value in the formation of an opinion by an expert (and the jury) when reviewing a case. CBCT can be seen as an additional and important piece of information to help explain why the doctor did what he did or why an unfortunate outcome occurred. Additionally, CBCT provides powerful and easily understandable images for layperson jury.

Recognising the value that CBCT adds to a case does not necessarily indicate that CBCT is the standard of care in each and every case. The decision to obtain a CBCT study before the procedure is determined by the dentist based on his experience and knowledge of the case.

_Literature Support_

For any technology to be considered as a standard of care, a plethora of literature in support for the technology should exist. The literature must discuss the risk and benefits of the technology, its application to patient care, and guidelines and protocols for acceptable use.

To assess the influence of CBCT in the dental literature, the author performed a PubMed literature search in October for the words cone beam CT, cone beam CT + dental, cone beam CT + dental implants, cone beam CT + orthodontics, cone beam CT+ oral surgery, cone beam CT + endodontics in the search line. The results are in Table 1.

_Evaluation of Table 1 data clearly shows a significant presence in the literature of articles pertaining to the use of CBCT in the various disciplines in dentistry. The vast majority of literature discovered pertains to addressing the use of CBCT in treatment planning and diagnosis of patients in dental implant therapy, oral and maxillofacial surgery, orthodontics, and endodontics. Articles on new applications of CBCT technology to patient care were also prevalent in the sample. Some articles addressed the risk and benefits of CBCT but none denounced CBCT as harmful to the patient or insignificant in treatment planning and diagnosis. Two similar PubMed reviews of the literature on CBCT were performed by authors Alamri et al (Applications of CBCT in dental practice: A review of the literature. Gen Dent 2012: 60(5):390–400) and De Vos et al (Cone-beam computerized tomography (CBCT) imaging of the oral and maxillofacial region: A systematic review of the literature. Int J Oral Maxillofax Surg 2009; 38: 609–625). Both of these exhaustive articles demonstrate the plethora of literature addressing CBCT and its application in the many disciplines in dentistry._

_Professional Guidelines_

For a technology such as CBCT to become a standard of care in dentistry, guidelines for its use and application in patient care must be established by the organisational bodies of those disciplines in dentistry who employ the technology to treat patients. In dentistry, the dental practitioners most involved in the use and application of CBCT in patient care include general dentists, oral and maxillofacial surgeons, endodontists, oral and maxillofacial radiologists, orthodontists, and periodontists.

The American Dental Association has over 180,000 licensed dentists representing approximately 75 % of dentists in the USA. The American Dental Association published an advisory statement article in its principal journal, The Journal of the American Dental Association, in August 2012. The article discusses the many positive aspects of CBCT, but stops short of calling CBCT a new standard of care. Rather, the ADA encourages the dentist to use...
CBCT “selectively, as an adjunct to conventional radiography.” The ADA further recognises the value and presence of CBCT by including CBCT-related courses at its annual meetings and continuing education courses during the year.

The American Association of Oral and Maxillofacial Surgery (AAOMS) has over 9,000 members representing approximately 95 % of oral and maxillofacial surgeons practising in the US. Literature addressing the application of CBCT in oral and maxillofacial surgery has been around since 2007. The AAOMS has offered continuing education in the use and application of CBCT for patient care as far back as 2011. The AAOMS has worked with the IAC to develop guidelines and accreditation criteria for 3-D CBCT imaging. In a recent survey of OMFS residency programmes, 87 % of programme directors acknowledged the use of CBCT in patient care by their residents.

The American Association of Endodontists (AAE) and the American Association of Oral and Maxillofacial Radiologists (AAOMR) have released a formal position paper on CBCT. This paper makes many important points, such as limiting the field of vision to minimise radiation exposure and increase resolution, careful patient selection in CBCT, and the responsibility of the clinician to interpret the entire image. The position paper goes on to declare “the use of CBCT in endodontics should be limited to the assessment and treatment of complex conditions.” The article then lists nine of these “complex conditions”. In summation, the position paper recognises the value of CBCT as an adjunct to 2-D images and “CBCT may provide dose savings over multiple traditional images in complex cases”.

Literature pertaining to the use of CBCT in endodontics first appeared in the Journal of Endodontics in 2003. The American Association of Endodontists sponsor continuing education in endodontic related CBCT on their website and the organisation devotes valuable time at its annual meeting to CBCT as it relates to modern endodontics. Most residencies (44 of 47) in endodontics provide CBCT for patient care.

Literature pertaining to CBCT in dentistry dates back to 1998. The AAMOR devotes considerable effort to continuing education relating to CBCT both on its website, through CE events, and at its annual meeting. All seven ADA approved residencies in Radiology incorporate CBCT education and training into the resident curriculum.

The tremendous value of anatomic truth in complex orthodontic cases involving patients with cleft lip and palate, impacted teeth, and maxillofacial deformities is widely recognised and discussed in the literature. Review of the AAO annual meeting lecture syllabus shows CBCT is a prominent topic for today’s orthodontist. In a recent article in the Journal of Dental Education by Smith et al use of CBCT in orthodontic programmes in the US and Canada was evaluated. This article showed the following:

- 83 % of orthodontic programmes have access to CBCT,
- 73 % of programmes report “regular” use of CBCT in patient diagnosis,
- Areas of CBCT use focuses on diagnosis and treatment planning for: impacted teeth, craniofacial anomalies, TAD placement, TMJ assessment, upper airway analysis, and maxillofacial development.

Literature discussing CBCT in periodontics first appeared in the AAP journal over a decade ago. The American Association of Periodontist annual meeting agenda and the Journal of Periodontology demonstrate a heavy influence of CBCT in the field of periodontics. All 51 post-doctoral US periodontal programmes use CBCT in patient care.

The International Congress of Oral Implantologists (ICOI), the world’s largest dental implant organisation and provider of dental implant continuing education with an excess of 25,000 active members, published a consensus report on CBCT in its journal Implant Dentistry in April of 2012. In the article, authored by many leaders in the dental implant field, the ICOI states: “The literature supports the use of CBCT in dental implant treatment planning particularly in regards to linear measurements, 3-D evaluation of alveolar ridge topography, proximity to vital anatomic structures, and fabrication of surgical guides.” The ICOI reminds the dentist that use of CBCT must be justified in each case and should be considered as an imaging alternative where conventional radiographs may not provide sufficient anatomic truth. Literature discussing the application of CBCT in implant dentistry is ubiquitous and comprises the lion’s share of research in applying CBCT technology to dentistry. The vast majority of post-doctoral residencies involved in dental implant patient care and all private dental implant training courses in the US incorporate CBCT in their dental implant education curriculum.

Many professional organisations in dentistry for general dentists and specialists have weighed in on CBCT by providing recommendations, guidelines, and a position paper. While these guidelines are beneficial in establishing a society or specialty’s position on CBCT, they are not mandates. Recommendations, guidelines, CE programmes, and posi-

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CBCT in dental office

As the practice of the discipline changes in response to many factors including, but not limited to court verdicts, expert testimony, literature support, professional guidelines, cost of the technology, and reimbursement by third party payers; the recommendations, guidelines, and position papers may facilitate the evolution of CBCT into a standard of care. Thus, in 2014 the professional organisations that comprise dentistry may not formally declare CBCT is the standard of care for every patient, but these organisations do recognise the influence CBCT is having on the profession.

Educational Institutional Participation

For a technology to be considered a standard of care, those in the profession must be educated in its application in patient care. In US, 56 of the 57 dental schools (98%) have CBCT available for patient care for pre-doctoral students. Forty-seven (84%) incorporate CBCT education in their pre-doctoral curriculum. In a survey performed by the author and others 202 general practice residency (GPR) and advanced education in general dentistry (AEGD) programmes were surveyed regarding use of CBCT by their residents. Eighty-two programme directors responded to the survey. Of the 82 respondents, 56 (68%) of program directors (PDs) responded affirmatively when asked if CBCT was used in patient care by their residents. The author also surveyed 102 PDs in oral and maxillofacial programs in the US. Fifty-four PDs responded. Of the 54 PDs responding 47 (87%) affirmatively when asked if CBCT is used in patient care by their residents. In a phone survey of endodontic residencies, 44 of 47 PDs indicated their residents use CBCT in patient care. All seven ADA-approved oral and maxillofacial radiology programmes use CBCT in patient care. Additionally, all 51 periodontal residency PDs indicated that their residents employ CBCT technology in patient care. In orthodontics, 83% of US-based orthodontic programmes use CBCT in patient care.

Cost and Availability

The cost of CBCT machines today range from US$150,000 to US$250,000 with yearly maintenance fees in the US$8,000 to US$20,000 range. As with any emerging technology, advances create a secondary market for slightly used machines. Each new step forward in technology renders the CBCT machine of only a few years ago slightly out-of-date, despite its obvious value and its superiority to two dimensional films. As time progresses and advancement in the quality and capabilities of the newest machines demonstrate themselves, the slightly non-contemporary machine will represent a significant advancement for the dentist versus 2-D radiography, while not burdening the dentist with significant cost. This will undoubtedly lead to an increase in the number of dental professionals utilising CBCT in their practices. The bottom line for most practices in regards to CBCT machines is: can I afford this for my practice?

To determine affordability, the price of the machine (purchase and maintenance) must be considered against potential revenue generated by the machine. Revenue can be directly from patients, insurance companies, or from other dentists who utilise the CBCT machine. A cost-effective alternative to owning and operating a CBCT device can be the outsourcing of the study to a third party (dentist or facility) and in-sourcing the software necessary to employ the images in treatment planning and diagnosis.

CBCT machines are becoming ubiquitous as more dentists purchase the machines and more third party non-dentist owned imaging centres enter the market. Since more dentists and more patients are becoming exposed to the technology, patient acceptance will increase, facilitating the incorporation of CBCT into the mainstream culture of dentistry. The increasing omnipresence of CBCT technology will not singularly make it standard of care, but it will serve to increase patient awareness of the technology, which in turn will influence what the public perceives as a standard of care.

The insurance industry

Reimbursement from major insurance companies and government-sponsored health care is traditionally the last to embrace (i.e. pay for) a new service such as CBCT. Although codes for medical CBCTs have been around for decades, specific codes for in-office CBCTs began to materialise in 2009. Current reimbursement rates for in-office CBCTs average around US$300, provided the study is covered.

By providing dentists with a CPT code, the insurance industry has validated the technology of CBCT and thus acknowledged its value in treatment planning and diagnosis. As time progresses, insurance companies may, as they have in the past, require CBCT owner/operators to obtain a certification via the IAC or some other regulating entity for an owner/operator to qualify for financial reimbursement from any third party payer.

Two of the major malpractice carriers of the insurance industry (OMNSIC and MedPro) have influenced the evolution of CBCT as a new standard of care by offering coverage for CBCT owner/operators commensurate with the level of risk to which the
owner/operators are exposed. Were CBCT studies believed to be of little value or represent minimal risk these leaders in the dental malpractice industry would not offer such coverage. Additionally OMNSIC requires the owner/operator to have CBCT images interpreted by a dental or medical radiologist to minimise risk.

**Multispecialty use and recognition**

Dentistry has nine recognised specialties; four (oral and maxillofacial surgery, endodontics, oral and maxillofacial radiology, and orthodontics) and the American Dental Association have produced literature to address the impact of CBCT on patient care. Of the remaining five specialties, periodontics and prosthodontics could logically be appropriate groups to produce a position paper on CBCT given their members participation in dental implant treatment of patients. Paediatric dentistry may soon provide a position paper once the long-term studies have been done to assess the risk versus benefits analysis with respect to the total overall radiation dose and its effect on the paediatric population. The specialty of dental public health is unlikely to weigh on the matter.

The value CBCT has in diagnosis and treatment of patients is widespread and recognised by medical disciplines such as plastic and reconstructive surgery, ENT, Craniofacial/CLP surgeons, and OMFS trauma surgeons. These medical disciplines recognise the high quality three dimensional detail CBCT provides and assists doctors in the treatment planning and diagnosis of their patients. Such widespread and multidisciplinary application of CBCT imaging contributes to CBCT is becoming a new standard of care.

**CBCT in the dental culture**

Many in the dental profession acknowledge the benefit of 3-D imaging to patients and doctors. There is little dispute that CBCT provides superior representation of the anatomy verses 2-D plain films. Quality of product acknowledged, at least four aspects of CBCT must work their way through the dental culture before CBCT becomes a standard of care: cost, availability, legal, and patient expectations. Two of these aspects (cost and availability) will more likely than not be determined by the invisible hand of the market as the Keynesians laws of supply and demand move the dental industry to provide the best possible service at a price patients and insurance companies are willing to pay. The third (legal) will be slowly determined in the court systems as attorneys and experts begin to rely more on CBCT in support of their clients’ cases.

Patient expectations are difficult to accurately ascertain. We know patients expect our practices to be contemporary. Buying the latest and greatest machine for your practice may not be wise if cost exceeds benefits both clinically and financially. As CBCT becomes widely accepted and expected by our patients due to aggressive marketing or clinical relevance, incorporating the technology into one’s practice may not be entirely necessary but prudent as others in the profession who possess the technology appear to be more contemporary and advanced in their patient care.

There are many questions yet to be answered definitively regarding CBCT:

1. Who is responsible (and liable) for interpreting the images?
2. Is an entire field of view interpretation necessary or simply the pertinent structures?
3. Must all images be interpreted by a board certified oral and maxillofacial radiologist or can the ordering doctor interpret the images?
4. What level of training is sufficient to own and operate the machine, as well as, and interpret CBCT images?
5. What cases deserve a CBCT?
6. If the patient refuses a CBCT and the dentist believes a CBCT is necessary for successful case completion, must the dentist complete the case without the CBCT study or can he refuse the case without fear of legal repercussions?

Lastly, as mentioned earlier, standard of care is an evolving concept. Darwin stated clearly any organism (or concept in this case) which is subject to the laws of evolution must adapt in response to outside forces in order to survive. The standard of care in dentistry is adapting to CBCT as forces (legal, financial, clinical, and consumer) act upon the industry to account for the powerful influence CBCT has on treatment planning and diagnosis of patients. While recognising that all that glitters is not gold, CBCT may soon represent a new gold standard by which many cases will be judged.

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Introduction

Deeply impacted lower third molars may have a close relationship to important anatomical structures, including the mandibular canal, the lower border of the mandible and the lingual cortex. Therefore, surgical extraction could be affected by severe complications, such as excessive bleeding, infection, nerve damage, accidental root displacement or even a mandibular fracture.

Today, a panoramic radiograph is considered to be the standard diagnostic tool for the localisation of impacted third molars and for preoperative planning. However, three-dimensional radiographic modalities (CBCT) are required in cases where there is a close proximity of the impacted third molars and the mandibular canal, in order to provide more accurate information and to avoid injuries and complications.

Case report

A 48-year-old female patient was referred to our clinic for the management of an infection, associated with an impacted right lower third molar. The level of the infection indicated a 5-day course of Amoxicillin 500 mg (Sinacilin, Galenika AD) and Metronidazole 400 mg (Orvagil, Galenika AD) three times a day. A regression of the infection could be observed and the patient was scheduled for the surgical removal of the impacted third molar.
The panoramic radiograph revealed that the right lower third molar was deeply impacted and close to the lower cortical margin of the mandible, showing a potential risk for a mandibular fracture. In addition, the analyses of the panoramic radiograph presumed a close contact between the impacted molar and the mandibular canal, because the roots of the impacted molar showed bright intervals in the lower third (Fig. 1).

In order to better visualise these anatomic relations a CBCT (SCANORA 3Dx, SOREDEX) was acquired. The CBCT images were edited and viewed in OnDemand3D software (Cybermed) and could clearly visualise that there was not that close anatomical proximity of the deeply impacted right lower third molar and the mandibular canal. The mandibular canal runs on the buccal side (blue arrow, Fig. 2).

The mandibular canal is most frequently located and runs lingually, and the surgical approach is most commonly made from the buccal side. Without a CBCT radiograph, there is a great risk of damaging the inferior alveolar nerve, when following the common surgical protocol for wisdom teeth removal.

The CBCT scan also revealed that the lower cortical margin of the mandible had been fully intact (Fig. 3), which decreased the risk of an intraoperative mandibular fracture. On the other hand, the CBCT image showed that the roots of the deeply impacted right lower third molar were penetrating the lingual cortex in the middle and lower third of the mandible body (Figs. 3 & 4). Thus, there was a substantial risk for an accidental root displacement into the sublingual space, excessive bleeding and in calculable complications, e.g. infections of the upper respiratory tract.

**Conclusion**

In cases of deep impaction or close proximity of impacted teeth to important anatomical structures, CBCT imaging is essential to support the surgeons in scheduling a precise treatment plan, avoiding complications and increasing the postoperative outcome.

_Editorial note: A complete list of references is available from the publisher._

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Challenging multi-disciplinary approach to a damaged tooth in the maxilla

This case required a precise evaluation of the different alternative approaches and clinical decision making before deciding on the final treatment. A surgical approach would have involved extraction of teeth 11, 12 and 21, and enucleation of the significant cyst seen in the pre-surgical CBCT scan, followed by bone grafting to fill the cavity. This would have required placement of an additional one or two implants and restoration with either three single implant-retained crowns or an implant-supported three-unit bridge. It was determined that the surgical approach was too traumatic and would cause extensive loss of vital tissues, making it difficult to establish a good aesthetic result later on. It also would have required the patient to lose three of his four front teeth, which would have been psychologically traumatic. Endodontic therapy was chosen instead in order to decompress the cyst and thereby save the teeth, retain the ridge form and preserve the interdental papillary tissue and architecture.

The initial view of the linked crowns at the 11 and 21 sites showed an unaesthetic appearance with poor soft tissue health and colour (Fig. 1).
A pre-surgical radiograph revealed root of tooth 21 to be resorbing, with apical radiolucency at 11 (Figs. 2a & b). After extraction of tooth 21, resorption of the socket wall was evident (Fig. 3). Therefore, a graft with bone substitute material and coverage with a membrane was performed (Fig. 4) to prevent collapse of the buccal plate. The wound was sutured and a laboratory-made four-unit temporary restoration was delivered (Fig. 5).

One year was allowed for post-graft healing, as well as to allow for decompression of the radicular cyst. At the one-year follow-up, the soft tissue appeared healthy (Fig. 6). Figure 7 shows the virtual placement of a 4.8 mm x 13 mm OsseoSpeed EV implant, as viewed in a cone-beam computerised tomographic (CBCT) scan using the SIMPLANT software.

The implant was placed utilising a flapless approach and a 4.8 Ø 6.5 mm HealDesign EV abutment was placed to support transmucosal healing (Fig. 8). After an impression was taken, the Implant Replica EV was connected to the Implant Pick-Up EV (Fig. 9). A plaster model was created and scanned.

These data were transferred into the ATLANTIS VAD software. Figure 10 shows the virtual design of an ATLANTIS abutment in gold-shaded titanium. This abutment was placed in the model with gingiva mask, and final individual full ceramic lithium disilicate crowns (IPS e.max) were created (Figs. 11 & 12).

The ATLANTIS abutment in gold-shaded titanium was installed using an abutment screw tightened to 25 Ncm (Fig. 13). Figures 14 & 15 show the facial and occlusal view of the final restorations at delivery, with full ceramic crowns at teeth 12, 11, 21, and 22. A radiographic image taken when the final crowns were inserted demonstrates an excellent restorative fit with stable marginal bone levels (Fig. 16). Six months after the crowns were inserted, a follow-up examination of the patient revealed excellent peri-implant tissue health (Fig. 17).
Papillon–Lefèvre syndrome is characterised by palmoplantar keratoderma and severe inflammation and degeneration of the periodontium due to periodontitis. Consequently, most primary teeth are lost by the age of 4 and most permanent teeth by the age of 14.

An alternative to conventional management of the disease, that is, dentures, is a treatment proposed by Drs Ahmad Al Zahaili and Jean-François Tulasne (developer of the partial bone graft technique used). Their groundbreaking surgery entails transplanting bone extracted from the cortical external surface of the parietal bone to the patient’s mouth. In the case reported in this article, the surgery afforded the patient the opportunity to lead a normal life since losing all of his teeth and the surrounding bone at the age of 13.

The 21-year-old patient was referred to our clinic by his implantologist from Boston University, who had made the acquaintance of Drs Tulasne and Al Zahaili at an international conference and thus knew about the possibilities offered by the partial bone graft technique.
Before treatment was started, the diagnosis was confirmed and we established that the patient could be treated under general anaesthesia. The diagnostic information was obtained from CT scans and radiographs of his maxillae, mandible and skull to check the bone skull density of the cortical external and internal surfaces. Surgical intervention demanded very precise diagnostics, which would have been very difficult to obtain without CBCT.

The surgery was performed under general anaesthesia (the treatment was performed at French Dental Clinic in Dubai). We first prepared the maxillae and mandible to receive the parietal bone grafts. We then collected the bone from the cortical external surface of the parietal bone and transplanted it to the maxillae and mandible, and secured it with surgical screws and then sutures.

After a healing period of three months, we established that the graft had been successful and had been properly integrated into the jawbone. We were extremely pleased with the results. Nine implants were then placed in the maxillae and six in the mandible. After another three months, the final restoration was seated.

The entire treatment process took approximately six months, but the results achieved were worth it for both the patient and us. The patient has been given the opportunity to have his own teeth without the compromise of wearing dentures at such a young age.

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Dental implantology is currently one of the most important treatment strategies for the replacement of missing teeth. The aim is to achieve a functionally stable, long-lasting implant, with an aesthetic outcome. Due to the reduced mechanical challenge, tooth loss induces progressive bone tissue atrophy. Thus, it is often necessary to reconstruct alveolar ridges before implants can be inserted.

Autografts

For three-dimensional (3-D) augmentations in cases of extensively atrophic ridges, onlay block grafting is the method of choice. Autologous bone is still considered the gold standard in block grafting. However, the intraoral availability of autologous bone for transplantation is limited. Therefore, bone harvesting from the iliac crest is required in cases of large defects.

Tissue harvesting, however, involves a second surgical site that is frequently associated with potential donor site morbidity and increased risk of pain. Furthermore, the harvesting of bone from the iliac crest is often
associated with pronounced and long-term neurological symptoms.

**Allografts**

Alternatively, allogenic bone (from human donor tissue, known as an allograft) may be applied to avoid the additional risks that come with harvesting autologous bone. Due to its physiological structure, allogenic bone provides an ideal matrix for revascularisation and new bone formation. Since it is fully resorbable, it supports natural bone remodelling. Moreover, allografts are biocompatible and, like autografts, do not induce immunological reactions.\(^1\)

Histological studies of the final stages of graft incorporation identified no difference between allografts and autografts.\(^2,3\) The allogenic bone tissue originates from living donors who are undergoing total hip replacement surgery and are willing to donate their femoral heads to support the supply of bone graft material for medical use. Donors have to meet high standard criteria in terms of their health status in order to be selected; systemic and neurological diseases, acute or chronic infections, and existing or past malignancies are only a few of the exclusion criteria.\(^1\)

Every single donor undergoes serological testing to detect the presence of virus antigens by nucleic acid testing (NAT). The donated tissue is processed in a multi-level cleaning process, which removes organic components and non-collagenous proteins from the mineral phase of the bone. This process is also validated for its effectiveness to reliably inactivate potentially present viruses and bacteria. The unique processing of the donor tissue preserves the natural collagen content of the allograft bone, rendering the material with increased flexibility, simple handling, and with more potential applications, compared to synthetic or bovine bone substitutes.

**Classical onlay block grafting**

The most important application for allografts is onlay block grafting; in the 3-D reconstruction of large defects, the block allograft ensures the necessary volume stability during graft incorporation. However, it is crucial during this initial phase of vascularisation and graft incorporation to establish the largest possible contact area between the block and the local bone bed.

During conventional block grafting, a standardised square block has to be manually modified for adaptation to the surface of the local bone during the surgical procedure.

Figs. 7–10, Complex reconstruction of the maxillary ridge by digital backward planning—superconstruction to customised bone blocks (patient data provided by Masoud Memari, Budapest, Hungary).

Figs. 11 & 12, Digital simulation of the milling process after import of the *.stl file in the CNC-milling machine.
It is a technique-sensitive and time-consuming process. Moreover, the prolonged exposure of the surgical site to saliva and air increases the risk of infection and delayed wound healing.

**Customised allogenic bone transplants for onlay block grafting**

botiss offers a new technology that provides the clinical user with a pre-fabricated, customised allogenic bone block, which is individually designed to match the patient’s defect.

The radiological data is transferred into CAD/CAM planning software that builds a 3-D digital model of the scans (Figs. 3–6, patient data provided by Dr Markus Schlee, Forchheim, Germany). Based on this virtual model, the botiss specialists design the allograft block directly on the virtual defect with...
the use of a digital backward planning concept (Figs. 7–10, patient data provided by Masoud Memari, Budapest, Hungary). Starting with the design of a possible superconstruction, the approximate implant position may be mimicked and virtual implants inserted. If the implants are digitally planned by the clinical user, these data can be transferred and the exact implant positions can be displayed in the 3-D model. The block graft is subsequently designed to fit around the virtual implants, according to the final bone bed needed for stable implant insertion.

_Individually designed in close cooperation between clinical user, CAD specialist, and tissue bank_

The complete planning process is a product of direct interaction between the clinical user, the CAD specialist, and the producing tissue bank. Bone blocks are individually designed to meet the requirements for sufficient augmentation of the alveolar ridge in careful consideration of the soft tissue situation of the patient, which can only be assessed by the attending surgeon himself. The final 3-D version of the bone block is converted into a *.stl file and transferred to the botiss partner tissue bank C+TBA (Cells and Tissuebank Austria, Krems). The block is produced under cleanroom conditions in accordance with pharmaceutical standards. The *.stl file is imported into a CNC-milling machine in which, after a simulated test run (Figs. 11 & 12), the final graft is produced from a partially processed allogenic block. After packaging and final sterilisation, the maxgraft bonebuilder block is sent directly to the clinical user.

In surgery, after it is brought into position, the maxgraft bonebuilder block is fixed with regular osteosynthesis screws. Residual gaps can be filled with bone regeneration material and the augmentation site is covered with a collagen membrane before the wound is closed tension-free (Figs. 13–15).

_Reduced surgery time, quick and uneventful wound healing_

The pronounced fitting accuracy of the bone builder block facilitates optimal revascularisation and graft incorporation. The operation time during block grafting is significantly reduced, thereby promoting quick and uneventful wound healing. It also allows the surgeon to focus on the management of the soft tissue, which is the actual key for success.4-6

Due to the significant reduction in operating time, costs and, most importantly, patient morbidity, the unique maxgraft bonebuilder technology paves the way for a patient-friendly, minimally invasive approach in alveolar ridge augmentation._

_Editorial note: a complete list of references is available from the publisher._

_About the author_

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Case report

Our office received a frantic phone call from the mother of one of our 12-year-old patients, who stated that her daughter fell while in P.E. class and broke a front tooth. We advised her to bring her daughter to the office as soon as possible. Immediately after her arrival, a periapical radiograph of tooth 21 and extraoral photographs were obtained (Fig. 1). Upon clinical examination and review of the digital radiograph, I saw tooth 21 was horizontally fractured at the middle third. There was no pulp exposure evident, but the tooth did have a pinkish tint on the lingual. No mobility was noted and no periapical changes or root fractures were obvious at this time. The new American Association of Endodontists guidelines recommend taking one occlusal and two periapical radiographs with different lateral angulations for all dental injuries, including crown fractures. If cone beam-computed tomography (CBCT) is available, it should be considered to reveal the extension and direction of the fracture.1

Dr Edward Mills, in his presentation on Site Development and Implant Protocol Based on

CBCT and CAD/CAM allow for one-day restoration of tooth 21

Author_Dr Robert Pauley, USA

Fig. 1

Fig. 2

Fig. 3

Fig. 4

industry report_use of CBCT and CAD/CAM

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Etiology of Tooth Loss, refers to a similar traumatic injury in which CBCT images revealed not only a root fracture within the bone, but a fracture of the lingual plate.2

A limited field three-dimensional (3-D) scan 5 cm x 5 cm at 300 voxels was taken with the CS 8100 3D to rule out buccal or palatal plate fractures (Fig. 2). None were evident on the scan. While her parents were upset that she had been injured, the ability to view a 3-D image reassured them that the damage appeared to be limited to the tooth’s coronal structure.

Treatment Plan

The patient’s treatment options were: 1) do nothing; 2) restore with a composite restoration, realising that this would have a questionable long-term prognosis due to the size of the fracture; 3) restore with a CAD/CAM milled crown. The patient and her parents were advised that cases where teeth have been injured traumatically such as in this case, one might experience a post-traumatic irreversible pulpitis at a period of time beyond the initial trauma. In some cases, this condition may be treated by endodontic treatment and crown restorations but in other cases root resorption may take place, precipitating the loss of the teeth. These teeth will be monitored every six months over several years with periapical radiographs. Every appropriate effort was made to maintain the tooth in place and avoid the need of an implant until the patient reaches maturity. Dental implants in adolescent patients may affect the vertical growth and development of the alveolar ridge because the osseointegrated implant acts as an ankylosed tooth. At a focus conference on Advanced Dental Implant Studies, Dr Mills summarised that jaw growth in a young adolescent patient may compromise the outcome of the oral rehabilitation using an implant-supported prosthesis even if implants were successfully integrated. After presentation of the treatment plan and discussion of risks, benefits, options, and alternatives, the parents and patient elected to restore tooth 21 with a CAD/CAM crown.

The parents understand this crown will likely need to be replaced once she reaches adulthood for the best cosmetic appearance, as her teeth and face will change with further growth and development.

Treatment

Tooth 21 was anaesthetised and prepared for a ceramic crown. I utilised the CS 3500 intraoral scanner to scan the prepared maxillary anterior quadrant and the opposing mandibular anterior quadrant, as well as obtain a bite registration (Figs. 3 & 4). CS Restore software was then utilised to design the anterior crown (Figs. 5–7). The CS 3000 milled the crown from an Ivoclar Vivadent e.max shade A1 size 12 ceramic block. We tried in the crown and took a digital PA radiograph to verify the margination, and made a slight occlusal adjustment on the lingual surface. The patient and parents were pleased with the appearance of the unglazed product. We polished, glazed, and added a slight white line on the buccal of 21 to mimic natural tooth 11. The crown was fired in the Ivoclar Programat.
Oven on e.max glazing setting. After a final try-in, the crown was cemented in place using Variolink translucent base and catalyst. We cleaned off the excess cement, verified the final occlusal scheme, and captured a final periapical image verifying cement removal (Fig. 8).

Post-operative instructions were given. The patient and parents were advised to call immediately if there was sensitivity, swelling, questions or concerns. I spoke with the parents and checked on the patient one day and one week post-operatively. She was proud of her new tooth and said it felt “awesome” (Fig. 9).

_Testimonial_

Carestream Dental products helped me gather valuable clinical information, diagnose, monitor treatment status, and provide better care for this patient. The digital radiographs initially captured by the CS 8100 3D to evaluate the tooth were clear and beneficial to determine fracture and position of nerve tissue. This clarity allowed us to see the bone pattern and periodontal ligament space surrounding the damaged tooth. In addition, the 3-D scan, taken at a 5 cm x 5 cm field of view and 300 voxels, allowed us to rule out buccal or palatal plate fractures before finalising the treatment plan. The various voxel settings let us select the best exposure time to image the structures we desire to view. This would not have been possible in the past with a panorex or digital 2-D radio-graph system.

The fact that we were able to provide the patient and her parents with a 3-D CBCT of tooth 21 gave them the opportunity to see and understand what was going on under the surface; ultimately resulting in positive acceptance of the treatment plan. I find that the CS 8100 3D unit gives me an incredible level of detail with actual size images that I can view from any angle or cross-section to get the best possible diagnostic image. CS Solutions (CS 3500 intraoral scanner, CS Restore software and CS 3000 milling unit) allows my office the opportunity to fabricate same-day permanent restorations. My patients appreciate the fact that our office is staying up to date with new available technology and giving them a safer environment with less radiation.

_References_


_about the author_

Dr Robert Pauley, Jr., DMD, has been practicing dentistry in the Atlanta area since graduating from the University of Kentucky College of Dentistry in 1988. Currently enrolled in the Advanced Dental Implant Studies, Dr Pauley is an Associate Fellow of the American Academy of Implant Dentistry and a Fellow of the International Congress of Oral Implantologists.

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Planmed Oy, part of the Finnish Planmeca Group, recently introduced a new maxillofacial imaging option to its breakthrough Planmed Verity Extremity Scanner.

Planmed Verity—a mobile 3-D unit without parallel

Fig. 1. MaxScan™ can be upgraded to all Planmed Verity devices.

Planmed Verity—3-D extremity scanner

The Planmed Verity extremity cone beam computed tomography (CBCT) scanner has been welcomed to the market with great enthusiasm and is already widely used in university and private hospitals and orthopaedic clinics. Orthopaedists, radiologists and extremity specialists, such as hand and foot surgeons, have been utilising Planmed Verity in challenging cases of both lower and upper extremities. It has been noted to be a superior tool in diagnosing complex wrist and elbow fractures. With its unique weight-bearing imaging capability, the scanner has also helped clinicians to gain new knowledge of the anatomy of the foot.

In addition to more traditional fracture imaging, a rising trend is the use of Planmed Verity for arthrography. In arthrography, an intra-articular contrast agent is used to enhance the visibility of the cartilage surface. Traditionally, magnetic resonance imaging (MRI) has been the main imaging method for joint space diagnosis, but recently contrast-enhanced CBCT arthrography has been found to be a competing method due to its superior resolution. If the cartilage
defect can be diagnosed during the first visit to the clinic, the patient will receive correct care earlier and perhaps even avoid larger surgical operations.

**Planmed Verity with MaxScan—new maxillofacial imaging option**

The new maxillofacial imaging option for Planmed Verity received CE approval in December 2013 and is already in use at several clinics in Europe. Just like in Planmed Verity orthopaedic imaging, special attention has been paid to patient comfort and image quality. Performing e.g. a sinus scan with a traditional medical CT unit can be uncomfortable for the patient. Planmed Verity solves this problem by providing a very convenient sitting position, where the open gantry design reduces anxiety. The lean-in type positioning also makes maxillofacial imaging a very fast procedure.

One of the biggest competitive assets of Planmed Verity with MaxScan is its low patient dose. It is therefore an excellent option especially for sinus imaging of small children. In addition to the low dose, the device offers superior image quality. Isotropic resolution of 200 µm, combined with advanced image enhancement algorithms, shows even the tiniest bone structures clearly. The 3-D information provided by MaxScan is far more informative than that of traditional 2-D X-ray or multi slice computed tomography (MSCT) devices with larger, non-isotropic voxels.

MaxScan is an excellent add-on feature to Planmed Verity. With this optional feature, it is easy to increase the patient flow for Planmed Verity and thus improve ROI. In addition to sinus imaging, MaxScan is a reliable tool for trauma imaging. Complex fractures are easily visualised in the 3-D data, and it also gives valuable information on the condition of the mandible, orbits, airways and temporomandibular joints (TMJ).

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**3Shape Implant Studio receives FDA market clearance**

3Shape is very excited about this FDA—510(k)—market clearance which opens the door to new service options for both clinics and laboratories in North America. Importantly, as more and more people are choosing dental implants to meet their restoration needs, Implant Studio will enable dental professionals to more effectively care for them,” stated Flemming Thorup, the company’s president and CEO.

3Shape has announced that it has been granted market clearance for the sale of its Implant Studio software in the US by the Food and Drug Administration (FDA). The software, which allows dental professionals to evaluate bone density and nerve position in patients for prosthetic implant planning and surgical guide design, will be available in the US in early 2015.

"3Shape is very excited about this FDA—510(k)—market clearance which opens the door to new service options for both clinics and laboratories in North America. Importantly, as more and more people are choosing dental implants to meet their restoration needs, Implant Studio will enable dental professionals to more effectively care for them,” stated Flemming Thorup, the company’s president and CEO.

The US dental implant market is projected to reach $5 billion by 2018. This development can be attributed to technological innovations and a growing aging population worldwide. Digital technologies in general have become increasingly important in dental implantology and more people are having dental implants placed. According to the American Academy of Implant Dentistry, 3 million Americans have implants and that number is growing by 500,000 per year.

3Shape stated that Implant Studio will be available through its resellers from the first quarter of 2015. However, availability to end users will depend on the specific system configuration. The software is already available in Asia, Europe and South America.

In addition, the company announced that its digital experts will be demonstrating Implant Studio, including complete workflows using intra-oral and CBCT scans, at the 2014 Greater New York Dental Meeting (Booth 424), which will take place from November 30 to December 3.

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**Fig. 1** 3Shape’s Implant Studio software. (Photograph: 3Shape)
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Even as early as the 1950s, the Serengeti had already gained worldwide attention through the numerous documentary films produced by Professor Bernhard Grzimek. The images from Serengeti darf nicht sterben (Don’t let the Serengeti die) were so powerful that he was awarded the Oscar for Best Documentary Film in 1960. Grzimek’s film reporting and personal commitment eventually led to greater sensitivity in the handling of Tanzania’s unique natural resources as well as the expansion and protection of Tanzania’s most important national park: the Serengeti.

Many naturalists consider it the most important national park in the world, given how the migration of wildlife depends on it to ensure their survival. It is the largest active mammalian eco-system, providing living space for a total of up to six million animals. During their long migration, millions of animals continuously traverse the full breadth of the Serengeti in search of food, and in the process cross the Mara River in order to reach the Maasai Mara in neighbouring Kenya.

Genesis of the project

A safari I took in connection with an expedition to Kilimanjaro in 2010 brought me to the heart of the Serengeti and from there northward to a small Maasai village named Ololosokwan on the border with Kenya. The very proud yet quite welcoming Maasai received me warmly. My guide,Seleu Kedoki, a local ranger with andBeyond who was well acquainted with the region, took me to the typical gath-
ering places for elephants, lions and leopards and also brought me to his village, where he proudly showed off a school and a small clinic. The clinic was a donation from andBeyond and AfricaFoundation and consisted of a well-built concrete building with seven rooms, two of which were furnished with equipment. A sign reading 'Daktari' that hung on the door to treatment room 4 had such a profound effect on me that right then and there I promised the resident physician, Dr Obed, to set up a dental care station there.

Conditions were perfect and I knew right from that first moment that we had found the location we'd been looking for so long, where we could establish a dental care project in Africa. After spending years working for Land Rover as a mobile dentist at off-road events like Camel Trophy, the Land Rover G4 Challenge and Land Rover Experience, I had long been interested in establishing a permanent site where we could reach out to provide medical services using off-road vehicles. Everywhere I went during my safari I was struck by the great lack of any kind of dental care.

Tanzania has a population of 52 million residents...but only 250 dentists. As a result, there are vast regions that must get by without any kind of dental care services. In general, patients have to walk great distances and undertake arduous journeys in order to get to a city for dental treatment. Moreover, the standards at most dental practices are still very under-developed so that in general many people are afraid of being treated. And often other needs in many areas are so great that dental care has to be put aside simply for economic reasons.
_The project gets under way_

It took nearly a year before our practice, Dental-Specialists, was able to launch the 'Daktari for Maasai' project. 'Daktari for Maasai' is Swahili and means 'doctors for Maasai'. Furnished with the best in mobile equipment and full of enthusiasm and a spirit of adventure, we travelled to our objectives at Lake Manyara, the Ngorongoro Conservation Area and the Serengeti. We were able to win over &BEYOND as our primary sponsor. This South African group operates lodges in the regions where Daktari works on behalf of the Maasai and provides assistance to the project on a daily basis. On the one hand, this affords dental and medical aid to even the most remote parts of Tanzania. Depending on the region, up to 90% of lodge staff are themselves Maasai in origin. Their families and other residents from surrounding villages gratefully draw on the dental and medical aid we offer. To do so, they will often walk 200 kilometres—while Maasai from the neighbouring Massai Mara will cross the border with Kenya in order to receive dental treatment from us. At the same time, for a project like 'Daktari for Maasai' to function, it is vital that it has reliable local partners like andBeyond to draw on. Through this collaborative effort, the project receives logistical and communications support at every level, affording it the consistency, security and predictability that the local &Beyond staff provide on the ground. This also results in a high degree of confidence among all those involved. The philosophy at &Beyond always places the preservation and development of nature and wildlife in the centre—along with providing practical support and development for the people in the regions where &Beyond operates. This can come about by building schools and clinics, or it may well take the form of appointing doctors to the clinics in order to ensure primary health care services. This is also what we provide through our collaboration with 'Daktari for Maasai', as we are in a position to offer highly specialised treatments that normally would be unavailable.

At the time I headed out with my colleague at Dental-Specialists, Dr Caroline Kentsch, on our first pre-scouting trip to Tanzania, flying with CONDOR
from Frankfurt/Main. On arrival at Kilimanjaro Airport, we acquired a long-chassis Toyota Land Cruiser 4X4 equipped for safari. It was the perfect vehicle, with excellent off-road capabilities and great load-hauling capacity. We first drove to Arusha to get additional medicines and instruments, since fifteen transport crates from Germany weren’t enough for it all. In Arusha we obtained a great many medicines and other instruments from medeor that medeor Tanzania had ordered for us. We then continued on to Lake Manyara, where we worked for the next two days, first treating the lodge staff and their families. After that, curiosity drew in a large number of other villagers. Following an arduous Serengeti crossing, we arrived at Ololosokwan, where we worked every day at both the Kleins Camp Lodge and at the Ololosokwan clinic. We initially needed help at the clinic, which still lacks both electricity and running water. A more or less functioning generator was provided and we adjusted our operations to fit our new surroundings among the Maasai. We quickly learned to deal with the heat, tsetse flies, mosquitoes, flies and numerous other insects. A smut candle specially designed to repel insects performed well, but caused masks and clothing to turn black. At the time there were still no dental chairs, so we had to treat patients while standing up all day. The patients themselves were treated either seated on an office chair or lying on a doctor’s couch. We gained valuable experience during this pre-scouting trip in the Serengeti that helped us prepare for our next visit.

Since we did not take any support staff with us the first time, we planned differently for our second trip. My close friend Dr Axel Roschker from Cologne, who specialises in implantology and oral surgery, went along to provide active support, as did two members of the staff at our clinic, DentalSpecialists. Sandra Ahsan worked independently with us as a dental hygienist and Miriam Schorn transformed herself into a veritable tooth fairy in the jungle environment at Lake Manyara, assisting Dr Roschker with his work.

Using additional materials obtained from medeor, we were able to equip additional sites. Now there are surgical suction pumps and instruments in Lake Manyara and in Ololosokwan. With a team consisting of in effect three persons providing treatment, we were able to handle over 650 Maasai in 14 days. Bit by bit, the project gained acceptance among the local population. Classes from the primary and secondary schools in Ololosokwan now regularly visit our highly specialised clinic. For the most part, these children arrive together as a class to receive treatment at the clinic.
Keeping the project going

During another project-related trip in January 2013, led by Dr Caroline Kentsch and Dr Axel Roschker, about 650 patients received treatment. Once again, two assistants accompanied three doctors on the trip. It is a welcome development that, owing to the technically advanced equipment available, we were able to provide treatments for pain that did not necessarily involve tooth extraction. Numerous glued synthetic bridges were produced to close gaps between front teeth. A great many cavities were filled in front teeth as part of treatment for tooth decay. And serious cases of fluorosis were treated in order to provide for a more aesthetically pleasing appearance.

Fluorosis is a wide-spread problem among the Tanzanian population. In the north, in the greater Arusha metropolitan area, up to 90 per cent of inhabitants suffer from serious cases of fluorosis. We also have been able to prevent tooth loss through root canal treatments. And we are able to preserve posterior teeth by putting in fillings. Using ultrasound equipment and mobile lasers, we are able to carry out comprehensive periodontal treatments. Korean-made digital X-ray machines by Dexcowin allow us to produce razor-sharp images in just seconds on a laptop in any kind of situation. These devices are absolutely vital in performing surgical procedures and root canal filling therapies.

In September 2013 the project achieved another milestone in its development when the University of Sevilla asked us to use the project as part of its training programme for oral surgeons. In September we travelled together with Dr Axel Roschker and two Spanish oral surgeons, Dr Roberto Garrido and Dr Francisco Azcarate, to Lake Manyara, Ngorongoro and Serengeti/Olologokwan. Joining us from England was Dr Andrea Chan, who previously served for six years as a dentist with the British Navy. Though she was only able to be with us for just one week, her visit came off smoothly owing to the availability of daily flights between Arusha and Olologokwan by small plane. Our multi-national team operated non-stop in every part of the Tanzanian mainland previously served. The international nature of the group spurred the project on immensely. The interactions of the individual specialists, despite never having worked together before, came off like a charm. This accomplished team of oral surgeons was even able to
handle more involved surgical procedures. And one thing quickly became clear: it was substantially more efficient to offer treatment as part of a larger team, since it meant that many activities could be shifted around so that highly specialised professionals were also available to serve as assistants. In February 2014 our path once again took us back to Zanzibar, where we had initiated a pilot project in February of the previous year. This time my other colleague at Dental-Specialists, Professor Michael Wainwright, went with us as well. Local conditions and climate on Zanzibar, however, pose greater difficulties in providing dental care than on the mainland. Daytime temperatures can easily climb above 33°C and the high humidity does its part to make any kind of physical activity difficult. We adjusted our treatment times and work habits to better suit this new environment. Because our facilities and equipment were located on a small offshore island, our patients reached us by boat. Life on the island made us feel a little like Robinson Crusoe. But the treatment we provided was affected by our underlying circumstances in other ways as well. While surgical procedures predominated on the Tanzanian mainland, on Zanzibar we treated a disproportionate number of serious cases of periodontitis. This is due, on the one hand, to a genetic predisposition to these types of diseases, but also to differences in diet. People on Zanzibar consume more fish and vegetables and sweets are harder to come by than on the mainland. Fluorosis is practically unheard of here too.
After extensive preparations while still in Germany, we had significantly expanded the equipment available to us. Along with our tried-and-tested surgical suction pump, medeor Tanzania made available to us a new Chinese treatment unit. It turned out to be a real adventure getting this equipment, however, given the great number of administrative hurdles and impediments we had to overcome before the unit was finally delivered.

DHL sent us daily assurances that the units would be arriving on schedule. But each and every time the African authorities put up another unexpected hurdle. One time the shipping documents were arbitrarily altered by a customs official; another time the equipment was removed from the flight, ostensibly because the plane was too heavy for the flight from Dar-es-Salaam to Zanzibar. Thank God we had another treatment unit to use in handling our daily flow of patients. It was only with help from the folks at medeor Tanzania and &BEYOND that we were able to find a solution to our administrative nightmare.

When the Chinese unit finally reached us, we were surprised at how compact and efficient it was. A highly efficient, integrated compressor makes the unit ready to use in just five seconds and it can be used for every kind of procedure, from putting in synthetic fillings to performing complex surgical operations. It makes for a very practical treatment tool that can even be checked in at the airport along with standard 23 kg luggage.

The unit constitutes the basis for all future mobile treatments undertaken by Daktaris for Maasai. And we would like to take a moment here to extend thanks to our third primary partner, Condor Contribute, for their help in transporting medical and dental aid supplies. Without their support a dental project as adventurous as this would scarcely have been possible. The thanks we got from the people of Tanzania receiving free treatment was indescribable and cannot be compared with any other experience in medicine. Sincerest thanks from the Daktaris for Maasai ...

Bon Voyage! – Na safari nzuri!
IMAGINA DENTAL

4TH DIGITAL TECHNOLOGIES & AESTHETIC DENTISTRY CONGRESS

1ER-3 APRIL 2015 MONACO

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Simplifying dental implant treatment

From 25 to 27 September 2014, more than 4,000 people gathered for the 23rd European Association for Osseointegration’s (EAO) scientific meeting in Rome. Dentists and industry specialists came from across the world to hear international experts describing the latest developments in implant dentistry.

Interactive sessions

The three day meeting in Rome featured arena sessions exploring ways of simplifying dental implant treatment without compromising quality or predictability. This year’s event saw a number of changes to the congress format. For instance, the main sessions were held under a theme that ran throughout the whole event for the first time. In order to render the sessions more interactive, speakers presented in the form of a debate, offering different approaches to the same clinical problem. Attendees had the opportunity to contribute using an innovative voting system via their smartphones to express their opinion on a particular question.

Awards for scientific research

There were also seven sessions where the best new scientific research was showcased. With 617 accepted submissions, a record number of abstracts were accepted for the congress in Rome. At a prestigious award ceremony, four European prizes for research in implant-based therapy were awarded for the best presentations and posters by Dr Bjarri Þorliefsson, a member of the scientific committee, and EAO President Dr Pascal Valentini. During the scientific meeting, three

European Prizes for Clinical Research in Implant Dentistry


Surgical Aspects. Awarded to: Yvonne De Waal (Netherlands): “Factors associated with success or failure of surgical peri-implantitis treatment.”


Fig. 1 More than 4,000 participants joint the 23rd EAO Congress.
candidates were also awarded the EAO’s Certificate in Implant-based Therapy. This is the only Europe-wide standardised assessment of skills and expertise within the field of implant-based therapy. Before being awarded their certificate, each candidate submitted six clinical cases, and then sat a multiple choice examination, as well as being interviewed about their cases. Certificates were awarded to Kamil Khabiev, Algirdas Puisys and Gang Chen.

_Dinner at the Vatican_

The social highlight was the EAO members’ dinner at the Vatican. 300 people experienced an exclusive private tour of the Vatican Museums and Sistine Chapel before sitting down to a four-course meal surrounded by ancient Greek and Roman sculptures. Demand was so high that the EAO organised an additional private tour for a further 300 people who were unable to attend the dinner.

_Upcoming congress_

The next scientific meeting will be held from 24 to 26 September 2015 at Stockholmsmässan, the Stockholm International Fairs and Congress Centre in Sweden, and will celebrate the 50th anniversary of dental implant treatment. The programme in Stockholm will reflect the progress the EAO has made over the last 50 years, as well as focus on current and emerging techniques. The sessions will educate participants on various aspects of implant dentistry, including tissue regeneration, challenges of implant treatment for elderly patients, digital technologies, peri-implantitis and other complications with dental implants.

“There is a strong emphasis on practical clinical messages that dentists can use in their daily practice. We hope that this combination of historical perspective and cutting-edge techniques will ensure there is something of relevance for everyone,” said president-elect Prof. Björn Klinge, who invited all of the participants to his hometown of Stockholm during the closing ceremony on Saturday afternoon.

Abstracts for the upcoming congress can be submitted from December 2014 until 1 April 2015.
International Events

2014

ADF Meeting
25–29 November 2014
Paris, France
www.adf.asso.fr

Great New York Dental Meeting
28 November–3 December 2014
New York, USA
www.gnydm.com

AAOMS Dental Implant Conference
4–6 December 2014
Chicago, USA
www.aaoms.org

2015

ICOI 2015 Winter Implant Symposium
22–24 January 2015
Orlando (FL), USA
www.icoi.org

2nd EADMFR Junior Meeting
8–11 February 2015
Freiburg/Breisgau, Germany
www.eadmfr.eu/junior-meeting-2015

150th Midwinter Meeting
26–28 February 2015
Chicago, USA
www.cds.org

Annual Meeting of the American Prosthodontic Society
26–27 February 2015
Chicago, USA
www.prostho.org

European Congress of Radiology
4–8 March 2015
Vienna, Austria
www.myesr.org

36th International Dental Show
10–14 March 2015
Cologne, Germany
www.ids-cologne.de

Academy of Osseointegration 30th Annual Meeting
14–12 March 2015
San Francisco, USA
www.osseo.org

IMAGINA DENTAL
4th 3D & CAD/CAM Digital Dentistry Congress
1–3 April 2015
Monaco
www.imaginadental.org

BIOHORIZONS Global Symposium
16–18 April 2015
Los Angeles, USA

EuroPerio 8
3–6 June 2015
London, UK
www.efp.org/europerio
Submission guidelines:

Please note that all the textual components of your submission must be combined into one MS Word document. Please do not submit multiple files for each of these items:
- the complete article;
- all the image (tables, charts, photographs, etc.) captions;
- the complete list of sources consulted; and
- the author or contact information (biographical sketch, mailing address, e-mail address, etc.).

In addition, images must not be embedded into the MS Word document. All images must be submitted separately, and details about such submission follow below under image requirements.

Text length

Article lengths can vary greatly—from 1,500 to 5,500 words—depending on the subject matter. Our approach is that if you need more or less words to do the topic justice, then please make the article as long or as short as necessary.

We can run an unusually long article in multiple parts, but this usually entails a topic for which each part can stand alone because it contains so much information.

In short, we do not want to limit you in terms of article length, so please use the word count above as a general guideline and if you have specific questions, please do not hesitate to contact us.

Text formatting

We also ask that you forego any special formatting beyond the use of italics and boldface. If you would like to emphasise certain words within the text, please only use italics (do not use underlining or a larger font size). Boldface is reserved for article headers. Please do not use underlining.

Please use single spacing and make sure that the text is left-justified. Please do not centre text on the page. Do not indent paragraphs, rather place a blank line between paragraphs. Please do not add tab stops.

Should you require a special layout, please let the word processing programme you are using help you do this formatting automatically. Similarly, should you need to make a list, or add footnotes or endnotes, please let the word processing programme do it for you automatically. There are menus in every programme that will enable you to do so. The fact is that no matter how carefully done, errors can creep in when you try to number footnotes yourself.

Any formatting contrary to stated above will require us to remove such formatting before layout, which is very time-consuming. Please consider this when formatting your document.

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Please number images consecutively throughout the article by using a new number for each image. If it is imperative that certain images are grouped together, then use lowercase letters to designate these in a group (for example, 2a, 2b, 2c).

Please place image references in your article wherever they are appropriate, whether in the middle or at the end of a sentence. If you do not directly refer to the image, place the reference at the end of the sentence to which it relates enclosed within brackets and before the period.

In addition, please note:
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- These image files must be no smaller than 80 KB in size (or they will print the size of a postage stamp!). Larger image files are always better, and those approximately the size of 1 MB are best. Thus, do not size large image files down to meet our requirements but send us the largest files available. (The larger the starting image is in terms of bytes, the more leeway the designer has for resizing the image in order to fill up more space should there be room available.)

Also, please remember that images must not be embedded into the body of the article submitted. Images must be submitted separately to the textual submission.

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Questions?

Magda Wojtkiewicz (Managing Editor)
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