The use of cone beam computed tomography (CBCT) has been in the industry for a while now and there is mounting evidence that in many cases the patient and the surgeon have benefitted from using these tools in the planning and postoperative evaluation of cases. In certain cases the use of CBCT should be mandatory due to the amount of beneficial information the clinician gets, thus reducing complications and achieving highly successful and desirable results, which in turn outweighs the risks associated with exposing the patient to a CBCT dose. These benefits have been described as detailed surgical/implant planning and execution of the desired treatment, operational predictability (by the use of surgical guides for example), use of the right volume and type of augmentation material, minimising postoperative complications by using new tools like virtual endoscopy to track vital anatomical structures, all leading to better results and a happier and more comfortable patient.

One of the most advanced new CBCT devices on the market that features all these benefits and many more is the new Acteon X Mind Trium 3D CBCT, which makes it the device of choice for any clinician who wants fully integrated technology for the daily clinical requirements. In this article we will examine some of these benefits and how the patients benefitting from this planning modality are so much happier and can return to their normal life immediately after the procedure.

CBCT planning
CBCT as we know can be used for planning the case, but CBCT itself can require some planning, and a CBCT device like the Acteon X Mind Trium can make that easy for the clinician by its easy-to-follow icons in the operating software. These are very easy to follow and it guides the practitioner through a series of settings to choose from, to target a focus area with the right exposure amount so that the patient does not get more radiation than necessary. One of the conclusions (among many) In a systematic review done by Bornstein et al in 2014 was that the clinician who prescribes CBCT should design task-specific protocols for the imaging goal, meaning considerations should be given to the exposure (mA and kVp) and minimum image quality needed for planning the case and restriction of the field of view, to properly visualise the region in question. Once these protocols have been established and the risks versus the gains have been determined, the clinician will have a better understanding of when to use CBCT. When the benefits are clear for both the practitioner and the patient, then CBCT could be without a doubt a clear choice of diagnostic and planning tool before surgery.

Dose reduction can be achieved by adapting exposure factors and utilising a smaller field of view (FoV) to the region of interest. A modern CBCT like the Acteon X Mind Trium exhibits these characteristics allowing the prescribing practitioner to be in control of these operating parameters by integrating easy preset (programmable) values in their operating software panel for different clinical needs and situations and taking the guesswork out of it for the operator. Also it allows for a scout view to be performed at a fraction of the CBCT dose in order to check if the area of interest is fully covered before exposing the patient to the required full dose for that particular area.

Reduced radiation dose
Replacing conventional computed tomography (CT) with CBCT as the standard of care has significantly lowered the radiation dose for patients, but obviously it is still higher than a 2D image, and it is down to the clinician to decide which one to utilise and when.

In this article we show some cases where a 2D image was not acceptable as a diagnostic and planning tool. Also we demonstrate how a 2D image using the same device was sufficient for a postoperative evaluation, thus eliminating the need for two CBCT images and exposing the patient to unnecessary radiation. Also in this article we show how a 2D image just wasn’t enough to give us full preoperative analysis of the situation, therefore a 3D image was preferable.

Planning a successful dental implant case may require the need of utilising a CBCT, especially if the case exhibits certain complexity or potential risk of complications and other considerations such as anatomic variations and their associated risks. Many clinicians across the globe simply do not do any surgery without utilising a CBCT 3D image.

Two schools of thought
Prior to writing this article, the author witnessed at a recent global osteology conference, two schools of thought regarding the use of 3D imaging using CBCT, and both sides had and defended their valid arguments.

On the one hand some defend the idea of using CBCT in the majority of cases based on the amount of invaluable information that a CBCT can produce for the clinician prior to surgery. This puts him or her in a better position to anticipate problems and reduce the risk of complications further down the line that may require using a CBCT anyway. Plus, all the aggravation and inconvenience that the patient (and the doctor) have to go through that could have been avoided if a CBCT was taken prior to surgery.

The same group went on to explain that for example, just by measuring and knowing in advance the bone thickness in the anterior region of the maxilla prior to extraction and immediate placement, one could avoid large amounts of bone shrinkage and dehiscence later. Knowing from the beginning how much bone thickness in the buccal aspect of the socket they are dealing with, could determine what type and extent of bone grafting material they needed to enhance the outcome and increase the cases predictability, especially in the aesthetic zone where demands for perfection are high.

The second group however, explained that due to...
the higher dose of radiation from a CBCT device versus 2D, but techniques (although much lower than the conventional CT), a more conservative approach has to be adopted for using CBCT and definitely not as often as some prefer to do.

Of course the use of a smaller FoV and a more considerate approach to exposure can help solve some of the dilemma around cases. Some of today’s modern devices are sophisticated enough to allow the dose to be reduced significantly by using a more targeted (focused) smaller FoV.

In the consensus statements and recommended clinical procedures published in the International Journal of Oral & Maxillofacial Implants, it states that ‘Current clinical practice guidelines for CBCT use in implant dentistry provide recommendations that are consensus-based or derived from non-standardised methodological approaches’. The paper also suggests that the decision to perform CBCT imaging for treatment planning in dental implant cases should be based on individual patient needs following a detailed clinical examination; however, when cross-sectional imaging is indicated, CBCT is preferable over CT because of the lower radiation dose to the patient.

Complex cases

In more complex implant cases, the use of CBCT and surgical stents can be considered mandatory to achieve a desirable outcome; however, even without a surgical stent and in less complex cases, the use of CBCT can be beneficial for the amount of extra valuable information that the clinician gets in order to plan and execute the treatment predictably. That is where a device with various FoVs can be useful, such as the Acteon X Mind Triumph 3D.

In fact, once the right decision has been made for a particular patient to have a CBCT image, it can play a large and important educational role to demonstrate to the patient the case in question and all the pathology and related anatomy and any specifics of the treatment. Patients always appreciate good visual information that is based on evidence. This obviously does not mean taking CBCT imaging for all patients just for educational purpose, but when the need has been established, the patient can be made part of it and they appreciate it.

Not every case is a complex case that needs full surgical stents and other complex planning tools and kits. A busy dental clinician can go through planning many cases small and large every day and not all of them need sophisticated tools. In the next section we will go over some day-to-day case scenarios where CBCT was a good and invaluable diagnostic aid and certainly helped make the lives of both the patient and the clinician easier.

The educational part of it for the patient was an eye opener, and the clinician managed to get a fuller picture of the case/pathology allowing him better judgement to plan the case in such a way that the outcome could be more predictable with no complexity.

In the following case scenarios the Acteon X Mind Triumph CBCT 3D versus 2D imaging was utilised for the diagnosis and treatment planning.

Case one

A patient (72 years old) was referred for mobility in her upper teeth with some radiolucency around some of her roots, and various other problems with a small upper removable prosthesis (Figure 1). The patient was extremely unhappy about the fact that she could not function well with these teeth and showed a desire for a fixed solution. Her medical history indicated that a year ago she suffered from a heart attack and that meant that now she was on anticoagulants.

In the following case scenarios the Acteon X Mind Triumph CBCT 3D versus 2D imaging was utilised for the diagnosis and treatment planning.

Case two

During a routine examination, this 55-year-old was concerned about her implants, especially her lower left last molar implant tooth as she had some problems in the past with this tooth, but also wasn’t sure about the condition of the lower right two implants and was under the impression that the bone has shifted.

After consulting with her GP and cardiologist, everyone agreed that she would benefit from a fixed solution – which is what she desired and can improve her quality of life. After examining the 2D periapical images from the referring dentist, a decision was made to have 3D imaging done in order to plan the case and the patient was involved at every step, so her consent for CBCT was obtained (Figure 2).

The CBCT procedure took no more than five to 10 minutes, however, planning the case took longer (one to two hours), as every aspect of the treatment had to be considered on how to make the procedure as simple and straightforward as possible for the patient.

The CBCT was examined thoroughly in all dimensions, and the simulated implant placement tools, together with the simulated bone density graphic tools, allowed for best locations after the extraction of the teeth.

The patient also preferred not to have any sinus lifts or anything else that may jeopardise her case since she did not want a more complex treatment plan because of her health.

On the day of surgery, the entire treatment took far less time than the patient anticipated. There was almost no bleeding or discomfort thanks to the thorough planning of the case and the exact execution according to the plans that were discussed between the clinician and the patient, resulting in a comfortable and happy patient and without risking her overall health (Figure 3).

At the follow-up appointment, the patient reported back that she never had to take any postoperative analgesics and she functioned normally afterwards (Figure 4).

All this was due to the detailed assessment and planning, taking patient’s health and condition into account and educating the patient about what was and wasn’t possible. The CBCT 3D imaging played a significant role here to achieve the desired outcome so far.

In more complex implant cases, the use of CBCT and surgical stents can be considered mandatory to achieve a desirable outcome.

Discussing different plans and solutions, the patient was very clear about her choice of treatment, which was fixed implant therapy and no removable parts as she also suffers from a very noticeable gagging reflex.

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the prognosis for these implants by correct treatment intervention at the right time, and turning complex cases into more manageable cases, saving the patient lots of aggravation and cost.

Case three
This young patient wanted an implant in the lower left first molar region; however, her panoramic radiograph (despite its adequate quality) failed to show clearly the alveolar nerve, making it a difficult task to trace or even guess where it might be (Figure 7).

After consenting to a partial CBCT image (focused area – less FoV than a full image), the clinician managed to get a clearer view (Figure 8) and managed to trace the nerve throughout to the mental foramen, thus eliminating any risks for nerve injury. Also showing the thickness of the available alveolar bone, allowing for a more accurate planning of the size of the implant for maximum prognosis.

Conclusion
The higher demands of patients for highly aesthetic outcomes in today’s dentistry makes the use of highly sophisticated and advanced technologies a must, especially in the fields of implant therapy, periodontics, endodontics and prosthetics.

It goes without saying that the more information the clinician has before a procedure, the better the planning and outcome.

3D imaging techniques, such as CBCT, can play such a role in providing the clinician with the tools for planning a more predictable case, thus minimising potential complications and creating better results.

Tracing a nerve path or planning a sinus lift or a bone block graft in implant therapy makes the use of a CBCT device indispensable. Some even wonder how they could ever have managed to work without it!

Of course the decision to perform CBCT imaging for treatment planning and evaluating cases should be based on individual patient needs following a thorough clinical examination and clear indications.

Also making sure that the device can allow for the change of exposure values and allows for different FoVs is important in reducing the effective dose. It is not true that some clinicians think they always have to have a large FoV for everything as certain cases require only a very limited and small FoV (in endodontics for example or a unilateral sinus lift to mention a few), therefore reducing the risk of unnecessary radiation to the patient.

A modern 3D device should incorporate many different clinical applications, such as panoramic, cephalometric in addition to the 3D imaging of very small to larger FoV, and the new Acteon X Mind Trium 3D CBCT device is exactly that. It is a complete system that can be used in many clinical situations.

Having a 3D imaging system is of true value in the dental practice both for the patients and the clinician. Patients appreciate the fact that their dentist made the effort and invested in such a high-tech item for their benefit and convenience and ultimately are very grateful.

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Reference