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DENTAL ASSOCIATION OF MALTA

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Editorial

By Dr David Muscat

Dear colleagues,

The DAM has very successfully organised a CBCT course in conjunction with UoM. Due to such a great demand we will organise another in the future.

The DAM committee is also planning further Basic Life-Saving courses for

dental practices and all their dental personnel. There will be a lecture where all will be invited to attend and then different groups will be invited to attend with their respective staff for the hands-on practical sessions.

We hope to see you at our Christmas party which will this year be held at

Port 21 in Ta' Xbiex. The front page is a picture of a painting of Saint Paul's Church, Rabat by the very talented and artistic Dr Jessica Lupi.

David

Dr David Muscat B.D.S. (LON)
Editor / Secretary, P.R.O. D.A.M.

We mourn the loss of Dr Vincent Gauci

Vince was a very amicable man, always with a smile on his face and with something nice to say about others. He was fun loving and generous and most of all a family man with sound principles. He used to attend most of the DAM events but especially St. Apollonia and the Christmas party and any social event.

I had the honour of being one of Vince's friends and celebrated various family milestones with him and his family. I also visited him and his wife Olivia in their quaint farmhouse in Gozo.

In his younger days, Vincent worked extremely hard but he would always find time to spend time in nature, especially taking his family out to sea on his boat. Santa Maria bay in Comino was his second home, where he would busily forage and fish for his lunch and dinner. He loved to gather capers, prickly pears and sea urchins and share his catch with the rest of the boaters.

I had the opportunity to travel with him to Madrid together with his son Chris and several other dentists years ago for a dental conference. I remember we had some great laughs; Vincent was always smiling and loved a good joke.

Vince had several interests and loved to dabble in DIY and carpentry, but his greatest passion was learning. He was an avid reader of educational, scientific and inspirational books on how to live life to the full. He was a gentleman as well as a scholar. Music was another of his great passions; He used to play classical music and also band music from Maltese feasts all day while he worked in his clinic. His patients will also remember him for his empathy; he was always ready to lend an ear and try to help in a holistic way.

Last December he attended the DAM Christmas party which he stated would be

his last. Even though he was quite poorly he made the effort to bid us farewell. That was the person that Vince was.

His funeral was well attended, and was led by Archbishop Emeritus George Frendo. At the end of the mass when the coffin was carried outside in the warm afternoon sun by his sons and grandson, a very beautiful poem was recited by his daughter Viola and then most poignantly a recording of Vince singing was played. Apparently the poem was written by Vince just before he died and it was found on his desk by his family. At this point I could not hold back the tears. A tear rolled down my face and I could taste the salt on my lip.

As the crowd paid their respects and went back to their respective lives I walked around the pretty bay of Marsascala. The Saint Anne Church stands proudly on a hill pronouncing Catholicism, the land on which it was built was generously bequeathed by the noble Mrs. Apap Bologna. The Oleander with its majestic five lobed pink flowers, the Indian Laurel fig tree, (in some Eastern cultures known to be a meeting place for spirits) and the Mediterranean Olive trees in Marsascala embellish the beautiful traditional fishing village. It is sheltered by Ras iz-Zonqor and Ras il-Gzira... Some have claimed that Saint Paul was actually shipwrecked in St Thomas Bay.

As the colourful luzzu boats in the bay rocked with the gentle wind, and the painted eyes of Osiris on each boat gave them a spiritual identity and ward off evil, another of the 'old guard' of the Maltese dentists was led away. I could not help but think about Vince smiling, on his boat, as it ebbed on the turquoise waters of Comino Bay anchored amongst the coves and creeks and deep caves, under the shadow of the Knights Tower and rugged cliffs and lush vegetation. 🙏





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Medicine Related Osteonecrosis of the Jaw in the Palliative Care Patient

Author: Phillipa Agius MDS – Year VI

Supervisor: Dr Nicholas Busuttill Dougall BChD (Melit), MFDS RCS Ed., FICOI (USA), MSc Oral Implantology (Fran).

ABSTRACT

This case describes the management of a patient in remission of Multiple Myeloma (MM) and metastatic prostate cancer referred to the University of Malta Teaching Clinic with signs of medicine related osteonecrosis of the jaw (MRONJ), following a biopsy taken down to bone because of tissue overgrowth in the anterior mandible.

Diagnosis of MRONJ has been widely documented, while an updated staging system has been recently published by the American Association of Oral and Maxillofacial Surgeons (AAOMS) in 2022. Osteonecrosis (ON) results in an indirect connection from the oral aversive microbiological environment directly into vital bone, this could lead to Osteomyelitis (OM) (Shuster et al, 2019). Radiographic manifestations on Dental Panoramic Radiography (DPT) and Cone Beam Computed Tomography (CBCT) of lytic lesions of MM, ON and OM occurring concurrently is extremely difficult for the general dental practitioner (GDP) to diagnose. Treatment of the patients' sequestra was conservative in nature allowing soft tissue to proliferate under the sequestrum. Once grade 3 mobility was reached, necrotic bone was safely removed with an underlying margin of soft tissue. Hyperbaric therapy was explored as a treatment option but due to the patient's recent state of remission of both MM and metastatic prostate cancer, it was deemed unsafe by his treating physicians.

Methods for pre-operative prediction of development of MRONJ in oncology patients has shown that bone turnover markers such as beta-C-terminal telopeptide (CTX) blood tests are ineffective. (Fusco et al., 2022). Radiographic pre-operative DPTs showing any form of infection and bone sclerosis have shown significantly higher rates of predicability of MRONJ after exodontia (Fusco et al, 2022).

With patients suffering from MRONJ, an adequately made prosthesis delivered at the right time, may improve quality of life by decreasing pain and improving function and aesthetics (Ali et al, 2021). This is also important to make sure the patient benefits from a well balanced diet, crucial for any cancer treatment. Recommendations to the GDP would be to not expose bone and adopt a multidisciplinary approach.

KEYWORDS

Multiple Myeloma
MRONJ
Prostate Cancer
Osteomyelitis

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INTRODUCTION

This case describes the management of a 76 year old male in remission of MM and metastatic prostate cancer, referred to the University of Malta Teaching Clinic with signs of MRONJ, following biopsy taken down to bone because of tissue overgrowth in the anterior mandible.

MM accounts for 1% of all cancers with a lifetime risk of 0.62%(Erdem et al, 2013). It is characterised by severe dysplasia and rapid duplication of plasma cells. The result of this active cancer in bone marrow is increased osteoclastogenesis(Silvestris et al, 2011). Radiographically, this will result in radiolucent lesions known as lytic lesions (Fusco et al, 2022). For the GDP, lesions in the jaws are of extreme importance. Treatment for MM includes chemotherapy, radiotherapy and bisphosphonates (Cowan et al,2022). The latter is used to regulate calcium levels in the blood and reduce the risk of pathological fractures due to the presence of multiple lytic lesions in bones. Nitrogen-containing bisphosphonates work by inhibiting the action of osteoclasts thus reducing the total resorption of bone however reducing its remodelling capacity, putting the patient at risk of MRONJ(Aguirre et al, 2021).

In addition to this, the patient also presented with metastatic prostate cancer in remission. When metastasis are present in bone, radiopaque sclerotic lesions are seen, resulting in haphazard densities with poor vascularisation (Aguirre et al, 2021). This poses an even greater risk for osteonecrosis.

The patient presented with islands of exposed bone in the anterior

mandible. Resulting in an indirect connection from the oral aversive microbiological environment directly into vital bone, this could lead to OM(Shuster et al, 2019).

Necrotic bone may result in the development of chronic OM. This infection may not exude pus or cause

pain during quiescent periods(Shuster et al, 2019). Invasive tests such as a bone core biopsy is contraindicated due to the high risk of MRONJ.

Thus, at this point the only method of non-invasive diagnosis is radiographic.This may be quite difficult especially for the GDP.

Medical history

Multiple myeloma	diagnosed in 2009 by a bone marrow biopsy taken from the ileum
Prostate Cancer	with Secondary Metastasis diagnosed in February 2020
Diabetes Mellitus Type 2	

Procedure history

Bone marrow transplant	2013, 2017
Chemotherapy	2012- 2015
Radiotherapy	2012-2013
Lung biopsy	performed 3 times due to shadows seen on CT scans, diagnosing metastasis.
Inguinal hernia repair	

Drug history

NKDA	
Zoledronic acid (Bisphosphonate - Inhibits osteoclast proliferation)	Started 2012 and stopped 25th Oct 2020
Goserelin (GnRH agonist - suppresses production of testosterone to stem growth of prostate)	10.5g every 3 months
Statin (HMG-CoA reductatse inhibitor - lower the level of low density lipoprotein in the blood)	1000mg daily
Prednisolone (Corticosteroid - suppresses immune system by suppression of the migration of polymorphonuclear leukocytes)	5mg twice daily
Atorvastatin	40mg daily
Metformin (Biguanide- reduces hepatic the mitochondrial respiratory chain in enhancing insulin sensitivity)	500mg daily

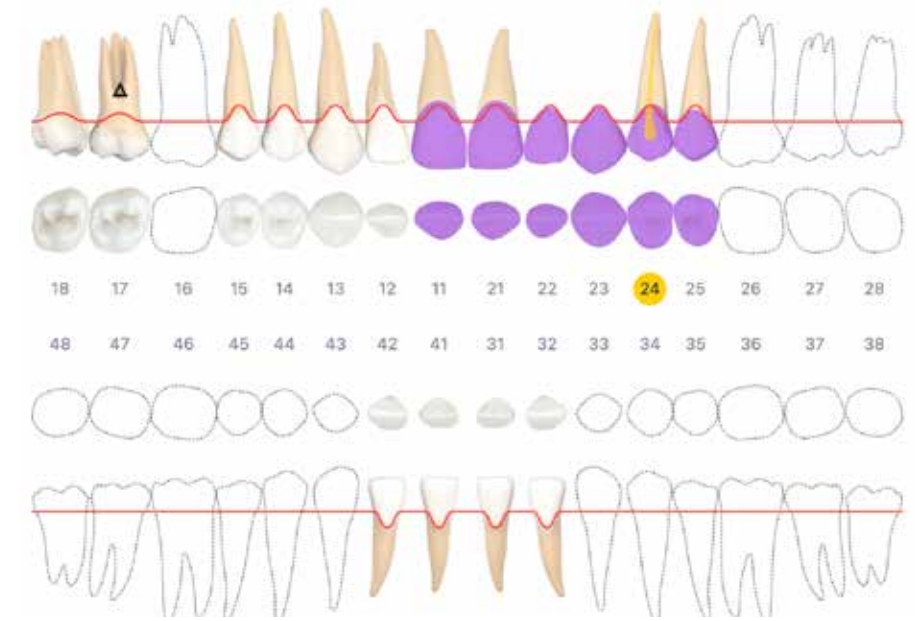


Image 1 - Dental charting-At initial appointment



Image 2 - Clinical Examination



Image 3 - DPT Examination

CASE PRESENTATION

A 74-year-old male was referred to the University of Malta, Teaching Clinic, due to long standing areas of bony sequestrations (2.5 months). This occurred after an excisional biopsy was performed in 3 months prior in private practice due to gingival soft tissue over-growth concluding the presence of an ulcerated fibroepithelial polyp with granulation tissue formation.

The patient is a retired civil worker, non-smoker, non-drinker.

Results of initial patient examination in January 2021 are shown in Image 1.

EXTRA-ORALLY (IMAGE 2)

- No abnormalities were detected

INTRA-ORALLY (IMAGE 2)

- Well defined areas of exposed necrotic bone in the area of 33 and 43 on the buccal area of the alveolar ridge.
- No pain, swelling, warmth or redness over the alveolar ridges
- 32- grade 2 mobility
- 31- grade 1 mobility
- 41 and 42 were stable
- No pathological periodontal pockets present around lower dentition
- Areas of moderate tooth-wear due to the loss of a mutually protective occlusion.
- Existing direct restorations and bridge in acceptable condition.

A DPT was taken privately (Image 3). Multidetector computed tomography (MDCT) was taken previously to diagnose metastatic spread also exposing the lower jaw and a CBCT was taken.

DPT - AT INITIAL PRESENTATION

- Stage 0 MRONJ- PDL space widening,
- Larger than average trabecular spaces

- Diffuse area of bone 5cmx1cm with varying grey scale levels to the distal side of the 42 extending by the apexes of 42 and 41 with a moth eaten border.
- Radiolucent spaces throughout the mandible and maxilla compatible with MM lytic lesions.

- No sclerotic lesions seen
- Crowns of the lower incisors had been splinted with composite. However this fractured due to overloading of occlusal forces on these teeth

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Medicine Related Osteonecrosis of the Jaw in the Palliative Care Patient

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MDCT

Taken for holistic medical diagnosis and treatment planning of active metastatic prostate cancer and MM. (Image 4)

Sagittal view of 3D reconstruction. Maximum Intensity Projection (MIP), showing different hyperdensities throughout the patient's thoracic bones. The large field of view (FOV) of this MDCT scan resulted in less than ideal quality conditions when focusing on the assessment of the mandible. (Image 5)

Highlighting the loss of hyperdense structure correlated with vertical bone loss seen in the lower anterior mandible. Moth eaten hypodense appearance with poorly defined borders characteristically seen in OM. This is seen in the sagittal plane of the right half of the mandible. Hypodensity also seen in congruence with larger trabecular spaces as seen in ageing patients.

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3D CT reconstructed model of mandible to pelvis showing osteonecrotic areas of the mandibular alveolar crest, even with the poor resolution due to the large FOV. Box series 3 - MDCT Imaging

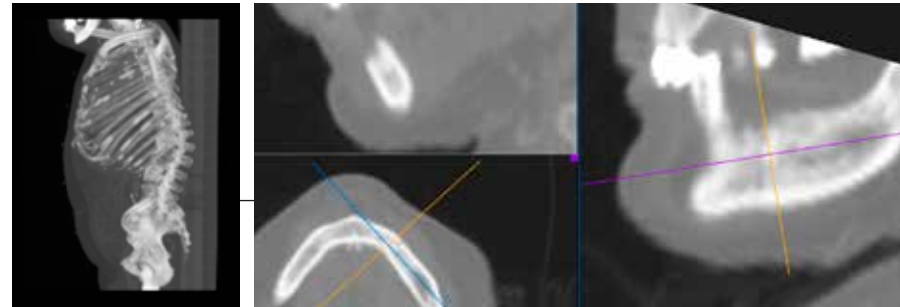


Image 4

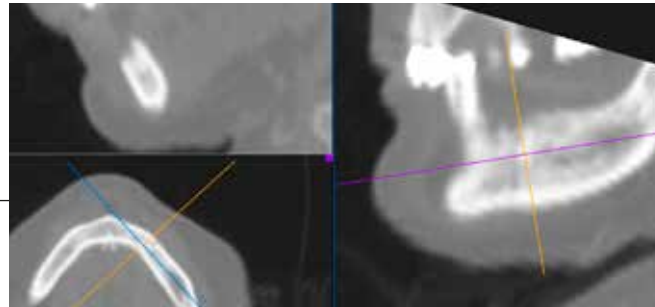
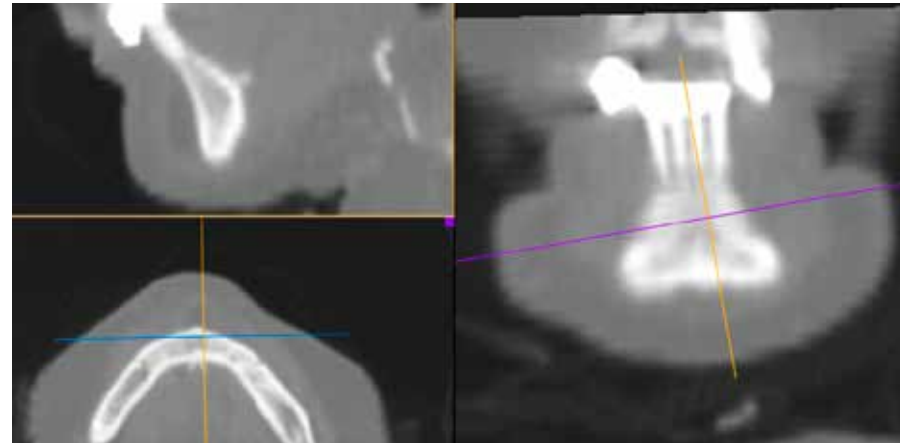
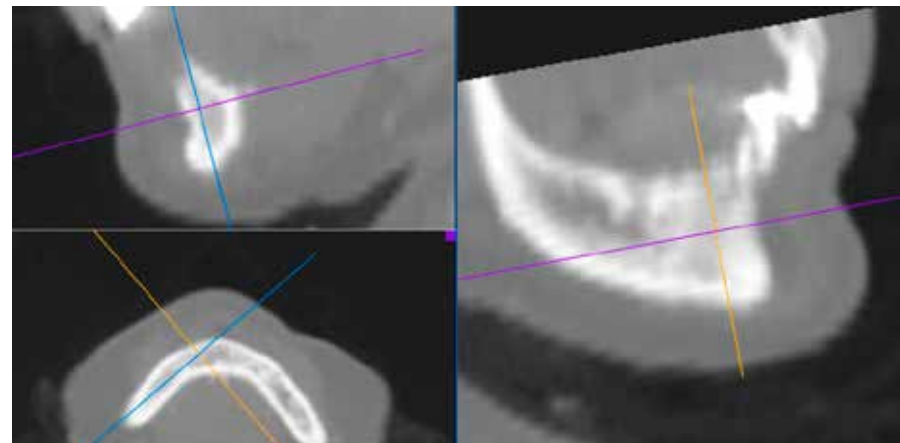


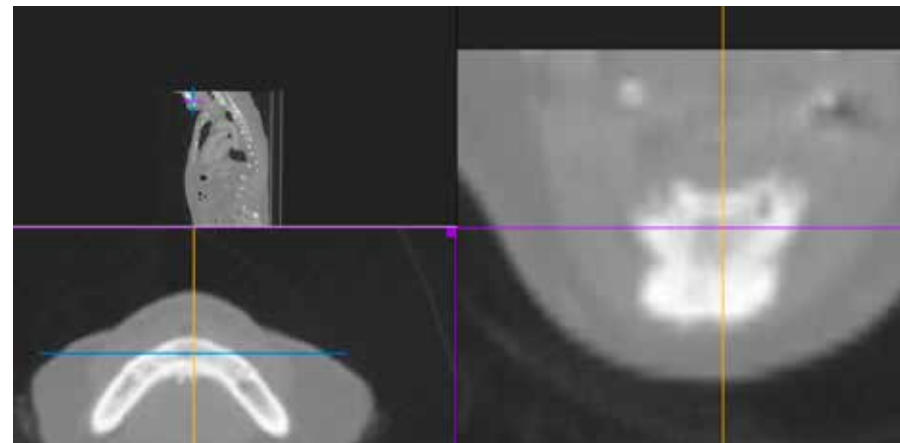
Image 5



Coronal view in MDCT showing loss of marginal bone and buccal plate suggestive of OM.



Sagittal plane of left half of the mandible showing hypodensity suggestive of osteonecrosis.



Highlighting the large FOV of this medical CT scan.

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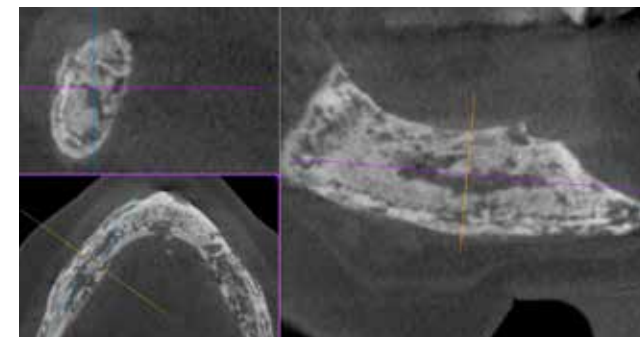
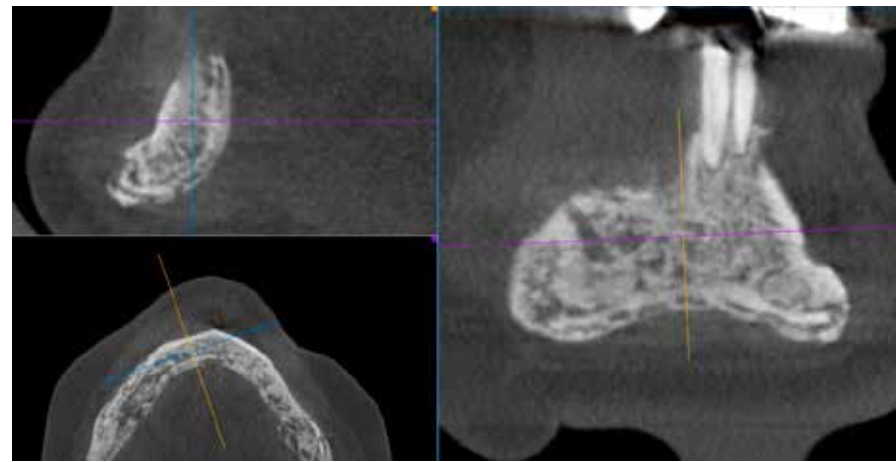
YOUR PATIENTS MIGHT AS WELL STOP BRUSHING IF THEY DON'T USE THIS.

Medicine Related Osteonecrosis of the Jaw in the Palliative Care Patient

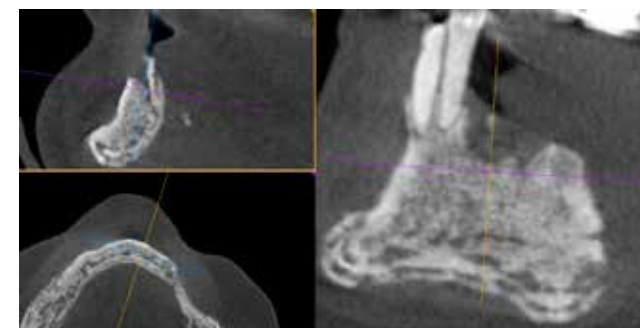
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CBCT

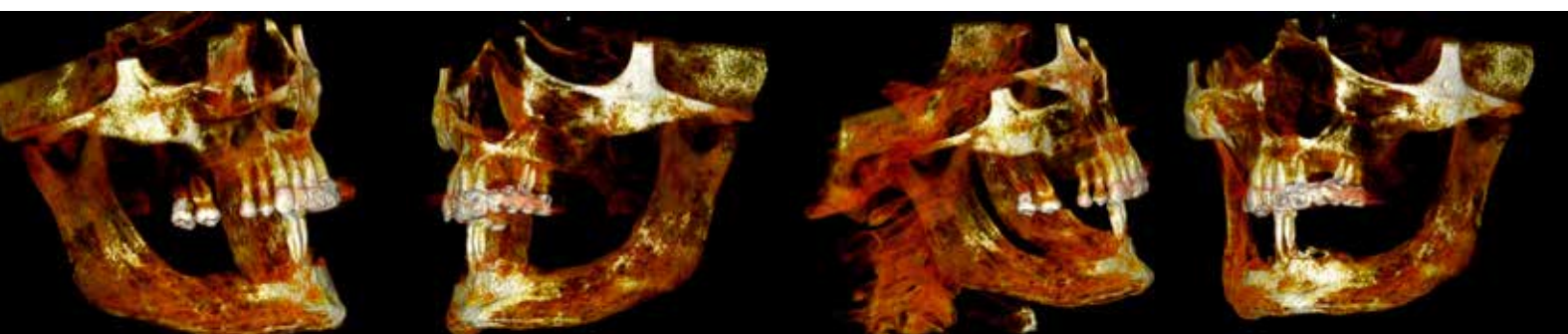
Ill-defined heterogeneous hypodense areas throughout the entire mandibular body, more pronounced at the alveolar crest of premolar regions, with thinning of the alveolar crest, buccal and lingual plates, as well as base of the mandible. Suggestive of OM. (Right)



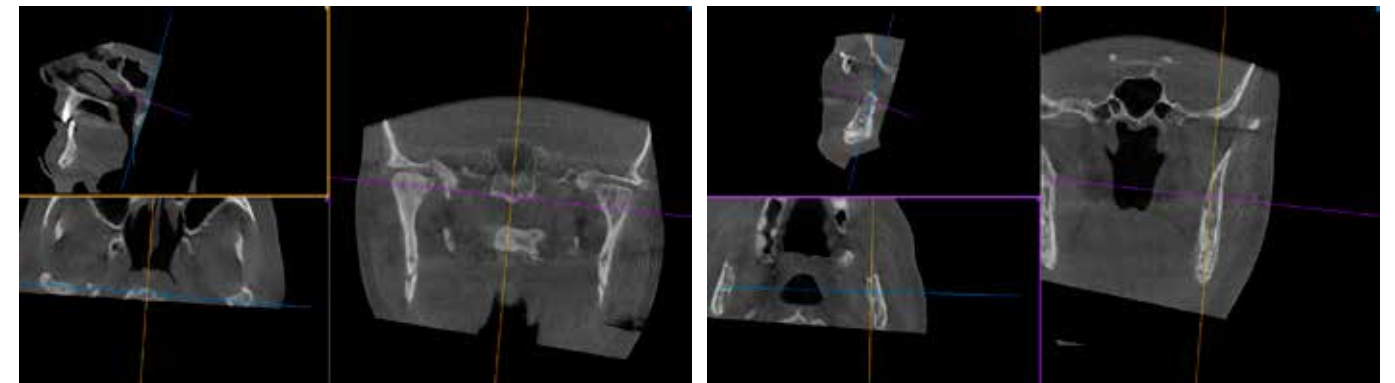
Above: Moth eaten resorption suggestive of OM
Right: Large hypodense circular space compatible with MM, lytic lesion alterations



Above: Large alveolar crest resorption shown by the ill-defined hypodense areas
Right: Hypodense large spaces are also seen, which could be suggestive of lytic lesions from MM.



3D CBCT reconstructed models illustrating alveolar crest resorption and large hypodense trabecular areas mostly in the mandibular body, compatible with both OM and MM.

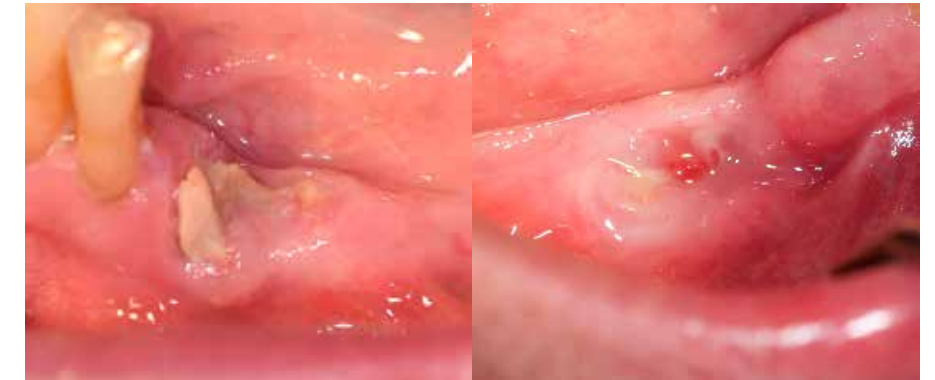


3D CBCT Multiplanar reconstruction, showing different radiodensities and pixel values between both condyles.

3D CBCT Multiplanar reconstruction showing the pathological involvement of the left mandibular ramus, with hypodense areas suggestive of bone resorption from OM at the mandibular angle.

EXAMINATION 3-MONTHS AFTER INITIAL PRESENTATION

Grade 3 mobility of bony sequestrum measuring 8mmx5mm was noted and carefully removed. Granulation tissue was present at the base ensuring epithelialization and no exposure of vital bone. (Right)



Bony sequestrum with portion of class 3 mobility

After clinical and radiographic investigations, the differential diagnoses were:

- MRONJ
- Chronic OM

Case discussions regarding treatment planning was done individually with the patient's oncologist, haematologist and oral surgeon.

Treatment Plan:

- Conservative treatment allowing epithelialisation to exfoliate sequestrum of necrotic bone
- Reinforced oral hygiene at every appointment
- Saline and chlorhexidine mouthwash
- Prosthodontic consultation for full lower denture



Granulation tissue seen at the base of the sequestrum not showing exposed bone

Bony sequestrum removed measuring 8mm x 5mm

Clinical examinations occurred every 3 months, allowing the lower incisors to exfoliate and heal unremarkably. Oral hygiene was re-inforced.

EXAMINATION 1 YEAR AND 3 MONTHS AFTER INITIAL PRESENTATION

Soft tissue slightly grown over exposed bone. Superficial gingival abscess medial to right lesion drained. Area irrigated with saline and chlorhexidine. Blood clot allowed to form over small area of exposed bone.



Images above, on the right and on next page

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The patient rejected attending his review appointment in January 2021 due to pandemic related health concerns.

Sequestrum of bone with grade 3 mobility in the left quadrant was extracted in two pieces using a curette. (Image 6)

REVIEW

1 year and 9 months after initial presentation – 2 weeks after previous appointment. Uneventful healing occurred resulting in successful conservative treatment of an avascular bony lesion. (Image 7)

DISCUSSION

The only oral manifestation of MM is bony swelling and/or pain (Ul Ain Iqbal and Majid, 2021). Radiographically, MM manifests as lytic lesions (Fusco et al, 2022).

Upon cancer remission, plasmacytomas leave defects in affected bones, 5- 30% of patients have osteolytic jaw lesions (Kumar et al, 2021), more common in the posterior mandible than maxilla due to quality of vascularisation, and in advanced disease.

These can be confused with any radiolucent lesions especially that of odontogenic origin if teeth are present (Beaumont et al, 2021). As widely documented, punched out holes seen on lateral cephalometric radiographs are a clear clinical presentation of MM. These lesions may appear in any bone leading to an increased risk of pathologic fracture (Melton 3rd et al, 2005).

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Image 6



Image 7

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Patients with MM also tend to take antiangiogenic and/or anti-resorptive drugs to reduce the risk of pathologic fractures, for pain management and to treat hypercalcaemia (Cowan et al, 2022).

These reduce the vascularity of bone and thus may cause osteonecrosis if bone is exposed to the oral cavity especially in older patients (Aguirre et al, 2021).

This poses a risk for super-infection resulting in chronic OM (Antau et al, 2019, Rosella, 2016). The benign nature of these oral manifestations is why clinical features of MM are known as ‘a wolf in a sheep’s clothing’ (Beaumont et al, 2021).

The GDP should be well accustomed to identification and safe management with a multidisciplinary approach. Diagnosis of MRONJ is as follows:

- ‘Current or previous therapy with bisphosphonates (all routes), Denosumab and / or anti-angiogenic agents
- Exposed bone or bone that can be probed through an intraoral or extraoral fistula(e) in the maxillofacial region that has persisted for more than eight weeks

- No history of radiation therapy to the jaws or obvious metastatic disease to the jaws.’ (Fusco et al., 2022))

Further classification from the AAOMS most recent position paper includes an updated staging system.

Considering the table below, the patient was diagnosed with Stage 2 ON due to presence of inflammation and infection in the gingiva around the exposed bone and loosening of teeth not explained by periodontal disease.

The British Journal of Oral and Maxillofacial Surgeons stated that ‘CBCT is required for identification, extension of lesions, possible complications and differential diagnosis of this condition. Two-dimensional imaging (DPT) does not provide the grey-scale sensitivity to diagnose osteonecrosis.’

Also, CBCT can only examine the bony extent of the lesion. To truly confirm the extent, a magnetic resonance image may be taken to observe the bone marrow affected (Dutoit and Verstraete, 2016). Lytic lesions from the MM are seen on DPT as well defined radiolucent areas whilst on CBCT are seen as large hypodense areas with well defined borders. This contrasts with

OM, appearing as a ‘moth-eaten’ appearance seen on DPT. CBCT would show peri-osteal reactions.

These lesions occurring concurrently and haphazardly in the jaws leads to near impossible identification of causation of specific lesions even to the expert radiologist. This highlights the multidisciplinary approach required.

To be able to confirm the presence of OM, a deep core biopsy of the mandible and blood tests checking the patients’ white cell count and inflammatory markers would have to be taken (Hirschfeld et al, 2019). These actions are contraindicated in this case because taking a bone biopsy requires exposure of bone which will most likely cause another area of ON.

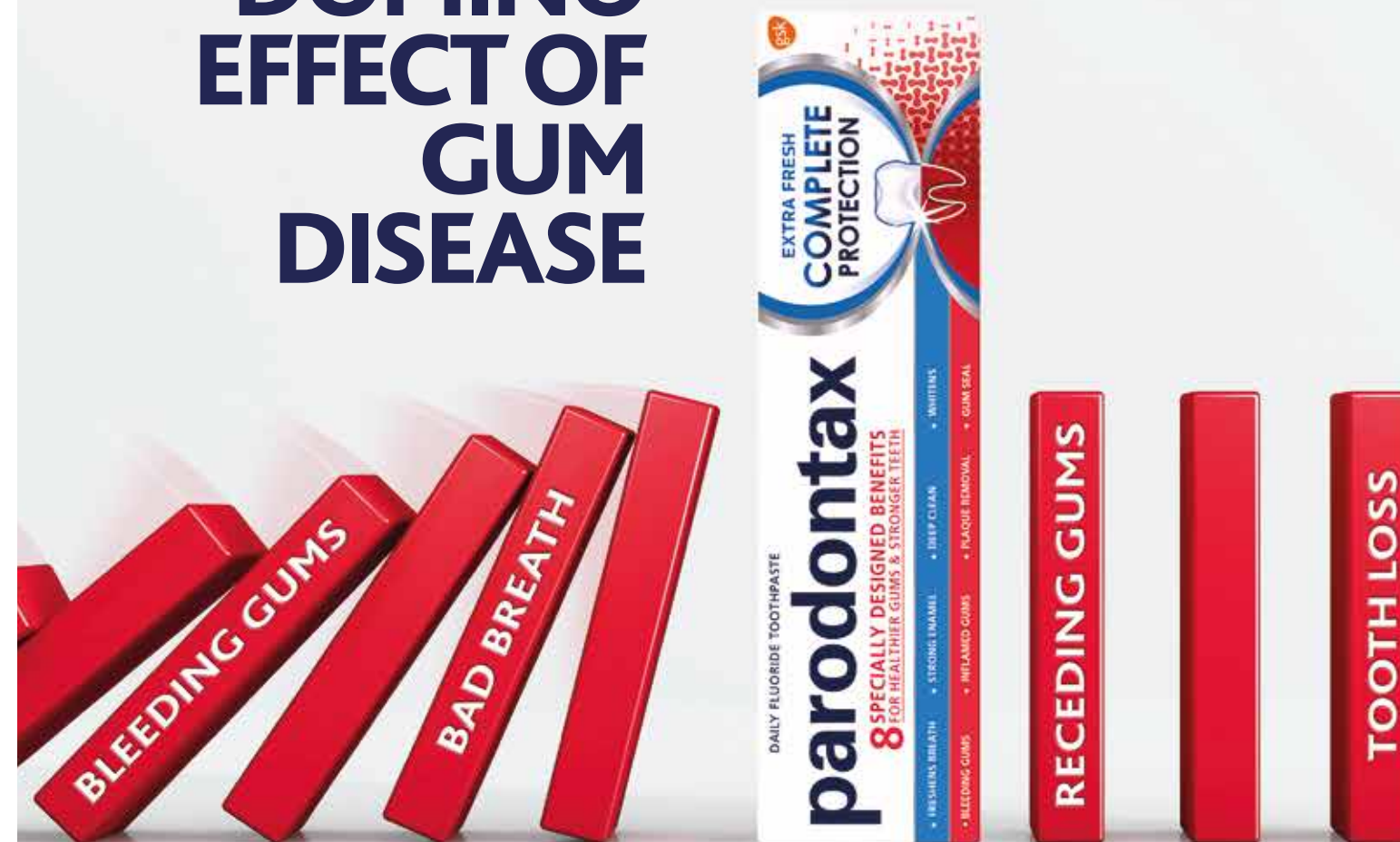
The patient had no symptoms of deep-seated pain even on pressure. Methods for pre-operative prediction of development of MRONJ have shown that bone turnover markers such as CTX blood test are ineffective. (Fusco et al., 2022). Salgueiro, 2019). Whilst radiographic pre-operative DPTs showing any form of infection and bone sclerosis have shown significantly higher rates predictability of MRONJ after exodontia (Fusco et al, 2022).

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	STAGE 0	STAGE 1	STAGE 2	STAGE 3
SYMPTOMS	Odontalgia not explained by an odontogenic cause.	Asymptomatic and have no evidence of infection/inflammation	Symptomatic patients with evidence of infection/inflammation	Symptomatic
CLINICAL	Loosening of teeth not explained by chronic periodontal disease.	Exposed and necrotic bone or fistula that probes to the bone	Exposed and necrotic bone, or fistula that probes to the bone	Exposed and necrotic bone or fistulae that probes to the bone, with evidence of infection, and one or more of the following:
RADIOGRAPHIC	Alveolar bone loss or resorption not attributable to chronic periodontal disease.	Stage 0 findings localised to alveolar bone region.	Stage 0 findings localised to alveolar bone region.	Findings extending past alveolar bone

Table 4: MRONJ Staging Classification from the AAOMS MRONJ Position Paper (2022)

HELP STOP THE DOMINO EFFECT OF GUM DISEASE



4x MORE EFFECTIVE VS REGULAR TOOTHPASTE
AT REMOVING PLAQUE BACTERIA*

Medicine Related Osteonecrosis of the Jaw in the Palliative Care Patient

Continues from page 14.

These radiographic signs have been classified as Stage 0 (Table 2), with 50% of patients progressing to Stage 1 MRONJ (Fedele et al, 2010. Fusco et al., 2022) In this patient, ill-fitting dentures lead to the consequences of denture hyperplasia which prompted the GDP to take biopsy exposing bone which never healed.

The biopsy result confirmed denture hyperplasia (Appendix 1) however due to the complex medical and drug history of the patient contributed to the development of MRONJ. In a study published by Sacco et al, they found that the mean (range) time of onset of ONJ/OM was 63 (24-130) months after the drugs were started (Sacco et al, 2020).

Our case showed the presence of a lesion far beyond the average time of development. The reason for this could be because bone was only exposed at the time of the biopsy. Treatment of the patients' sequestra was conservative in nature.

Gentle debridement was carried out. When this was not possible, since sequestra were still firmly attached, gentle easing to remove sharp edges was carried out.

Removal was only carried out when it was ascertained that soft tissue had proliferated under the sequestrum, thus sealing healthily underneath.

The epithelium will always continue to proliferate to close a wound until contact inhibition occurs. Clinically, once grade 3 mobility is reached, epithelialisation would have occurred under the necrotic bone and can be safely removed without posing a risk. Novel hyperbaric therapy studies

have shown safe treatment for osteonecrotic lesions in active oncology patients (Ortega et al, 2021).

Multidisciplinary consultations revealed that although studies have shown significant success rates, the oncologist rejected treatment because of the patient's recent advance to remission and its uncertain stability. The risks of both cancers growing, as well as the stimulation of any lung lesion with HBO was deemed too great to take.

Conservative methods such as that undertaken in this case are the preferred method of treatment. If the amount of exposed bone is amenable (Fusco et al., 2022).

In patients with a vast amount of exposed bone, surgical procedures have been widely documented removing all avascular bone, stopping when vascular bone is seen and closing a flap to heal by primary intention (Fusco et al., 2022) (Lobekk et al, 2021).

The literature is full of reports stating the unpredictable results are seen following such wide spread debridement (Fusco et al., 2022). Additional resective surgery of the jaw can lead to numbness, and loss of function which in turn will lead to dysmimesis, indigestion, general weakness, speech and esthetic problems (Okuyama et al, 2021). Judicious treatment planning approach should be applied to the elderly patients and end stage cancer patients (Fusco et al., 2022).

Ill-fitting dentures have been described to cause osteonecrosis of the jaw (Hasegawa et al, 2012). However, the patient has a greater masticatory potential with a full lower denture in comparison to an edentulous state. A nutritious diet is imperative for holistic patient care (Fusco et al, 2022).

When regions of MRONJ are present at the initial visit, a successfully delivered prosthesis may improve quality of life by decreasing pain and improving function and aesthetics (Ali et al, 2021).

Precautions taken during denture fabrication included:

- Mouthrinse with chlorohexidine mouthwash before every procedure
- Minimal pressure impressions and functional border placement
- Using a wax spacer in areas of avascular lesions
- Frequent recalls after delivery of denture
- Vigorous cleaning
- Instructions to wear only when eating
- A soft reline was not required, retention support and stability were satisfactory and pressure indicator paste was used to ensure no pressure on the avascular lesions. Tissue conditioner may also be used to further reduce pressure on the fitting surface.
- After removal of sequestrum, a soft reline was used to regain support, stability and retention of the prosthesis. Oral Hygiene was reinforced and frequent reviews undertaken.

CONCLUSION

In conclusion judicious treatment planning approach should be applied to the elderly patients and end stage cancer patients. Conservative treatment obtained satisfactory results. Recommendations for GDPs would be to avoid exposing bone at all costs.

Thus, extractions, dental implants, deep sub-gingival root surface debridement should be avoided. Sub-gingival restorations should be performed as a traumatically as possible with close reviews. Supra-gingival restorative procedures

are safe. Should MRONJ develop conservative care is the first line treatment of choice. Although, still in its infancy HBO may have a big role to play both in MRONJ and OM thus further studies are recommended in this area.

With continuous drug innovations, risk profiles may change thus consultation with the patients' medical practitioner is imperative to be able to formulate the appropriate treatment plan.

NOTES ON PATIENT CONSENT

Informed, valid and written consent was obtained from the patient.

ACKNOWLEDGEMENTS

I would like to wholeheartedly thank Dr Nicholas Busuttill Dougall for his unmatched guidance and trust in me with this case. Special thanks to Professor Cortes for his expert radiographic interpretations. Thank you to Dr Joanna Basic, Dr Nick Refalo, Professor Alexander Gatt and Dr Charles Azzopardi for their multidisciplinary expertise. Finally, great thanks to Professor Nikolai Attard, without whom none of this would be possible. 🙏

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Continues on page 19.

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Medicine Related Osteonecrosis of the Jaw in the Palliative Care Patient

Continues from page 17.

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THE ZHERMACK EVENT – MASTER IMPRESSIONS

By Dr Nicholas Charles – a Bart Enterprises event

Dr Charles who used to work in Milan took us through the chemistry of impression materials and then proceeded to give us a good hands-on exercise. He passed on certain tips such as the importance of THIXOTROPY the ability of a material to flow under pressure. The importance of using light bodied material and which trays to use with which heavy bodied putty material. With light bodied one can pick up detail of 20 microns on the margin. With perforated tray one has less of a thixotropic effect. The use of two retraction cords was discussed with first using a small cord and then adding on a thicker one.

The importance of disinfection of impressions was also highlighted. The differences in the properties of different impression materials was outlined. Polyether and alginate materials absorb water. Polyether -impregum .

A Polysulphide example is Permalastic. When you extrude the light bodied material the first part must be discarded.

When placing the light bodied hold the tip with your hands and guide it around the margin.. The tip follows the material.

Care must be taken with certain astringents used with the retraction cord as some interact with Polyethers. Eg. aluminium sulphate. Dr Charles prefers to use saline with the retraction cord to avoid any interactions.

One must avoid using Putty with extra light bodied Impression material due to the thixotropic effect. 📷



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ROOT CANAL IRRIGATION

A NECESSITY OR A WASTE OF TIME?



By Dr Maria Xuereb
B.Ch.D, MSc Restorative by research (Melit), MSc Endodontics (Lond)

Even though root canal irrigation is quite underestimated, the actual mechanical and chemical debridement of the root canal space is required to remove pulp tissue, micro-organisms, their by-products and the smear layer. The aim of endodontic treatment is to clean and debride the pulp space to eventually seal it off and prevent re-infection.

This article will help to:

- Understand the endodontic biofilm and the smear layer
- Thoroughly evaluate the aims of root canal irrigation
- Look at the most commonly used irrigants and the recent protocols and recommendations
- Understand any possible interactions between the different irrigants
- Discuss the different and most innovative irrigation activation techniques and devices

When discussing root canal irrigation, one must thoroughly understand the microbial biofilm and the smear layer.

The microbial biofilm can be described as a dynamic system consisting of microorganisms embedded in a self-produced extracellular matrix (1). The formation of this biofilm occurs

in 2 stages. In the first phase there is adhesion of different micro-organisms to a conditioning film. This is then followed by the second stage where growth and maturation of the biofilm occurs (1).

In 2004, Svensäter and Bergenholtz then proposed the presence of a microbial biofilm forming along the root canal wall (2).

The relevance of the biofilm when carrying out endodontic treatment is that since it harbours micro-organisms, mechanisms have to be proposed to remove it while also tackling the resistance it can induce.

The resistance can be the result of an actual physical barrier for the anti-microbial to penetrate the biofilm layers and also due to an acquired barrier resulting from cellular differentiation inside the biofilm itself (3).

The smear layer can be defined as a 'surface film of debris retained on the dentine or other surfaces after instrumentation with either rotary instruments or endodontic files; it consists of dentin particles, remnants of vital or necrotic pulp tissue, bacterial components and retained irrigants.' (AAE 2003).

In 1974 Brännström and Johnson observed a thin layer of debris deposited along the dentinal walls of a cavity preparation (4).

In 1975, Mc Comb and Smith proposed that a smear layer does not only form in the coronal part of a tooth when carrying out a restoration but can also form in the radicular portion along the root canal wall during endodontic treatment (5).

The smear layer is made up a loosely adherent layer along the root canal wall and a deeply impregnated smear plug along the dentinal tubules (6). The deeper the debris penetrates the dentinal tubule, the more difficult it is to dislodge it and flush it out (6).

The removal of the smear layer has been a controversial aspect in endodontics. Still, the recent recommendations are that the smear layer should be removed as it harbours and entombs bacteria, it can impede proper disinfection and irrigation of the root canal space while impairing the obturating material from adhering to the root canal wall (5,6).

Over the past years, the use of micro-CT has helped us clinicians understand that the root canal space

is actually a system with a complex anatomy made up of multiple accessory canals, lateral canals, fins and isthmuses that cannot be easily cleaned by conventional hand and rotary instruments (7). Clinicians must find other ways and means to debride these areas which are not that easily accessible to hand and rotary instruments (7,8).

One may therefore conclude that the ideal root canal irrigant should have a mechanical effect whereby it actually detaches the biofilm and smear layer from the root canal wall while also having a chemical effect by inducing an antibacterial and antimicrobial effect on the micro-organisms present along the root canal wall (9,10).

The most commonly used irrigant delivery method is syringe irrigation. In fact, this is the most commonly used control for most studies when novel irrigation delivery systems are being proposed (11).

Syringe irrigation works by a positive pressure technique whereby the difference in pressure in the syringe barrel compared to the atmospheric pressure drives the irrigant from the syringe into the root canal space.

The recommendations when using syringe irrigation are an adequate canal enlargement (with canals having a minimum size of 30-35 with increased taper), a fine needle to reach adequate length (at least 30G) and a flow rate of approximately 0.25 mL/s. The latter is still quite difficult to assess clinically as it is quite subjective (11,12).

There are 2 main types of needles: the open-ended and the close-ended needles. With the open-ended ones, the jet is intense and always directed apically while with the close-ended needles, the jet divergence leads to a decreased velocity towards the apex (13).

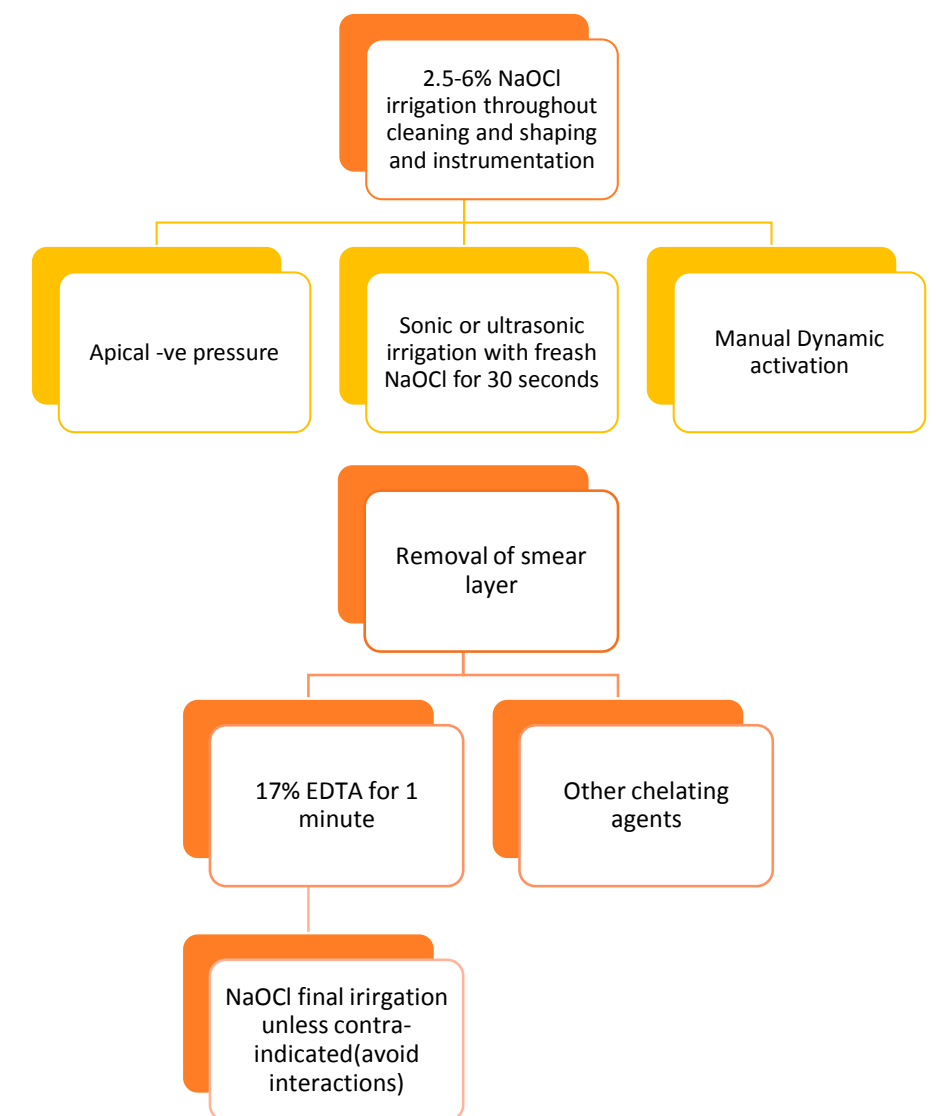
IRRIGANT INTERACTION	
NAOCL + CHX	Chloroaniline (brown precipitate) forms Recommendations – use another irrigant in between or dry canals with paper points (19)
CHX + EDTA	White precipitate forms. Easy to wash out. No irreversible chemical reaction (19).
NAOCL + EDTA	Champagne effect EDTA reduces tissue dissolving capacity of NaOCl. Nullifies antibacterial effect of NaOCl. Formation of chlorine gas and hypochlorous acid (19,20).

Clinical tips when using these 2 types of needles are that with open-ended needles you should always stay 2-3mm short of the working length.

With the close-ended ones the distance can be less even though the clinician should always avoid binding and very high forces to avoid irrigant extrusion.

Sodium hypochlorite is the gold standard irrigant used in endodontic treatment. It is a strong base and the mechanism of action mainly involves the free chlorine in solution forming chloramines which will impede microbial metabolism and also dissolves organic tissue (14).

Continues on page 24.



Summary of irrigation protocol as previously described

ROOT CANAL IRRIGATION

A NECESSITY OR A WASTE OF TIME?

Continues from page 23.

Concentrations can range from 2-6%. Obviously the higher the concentration, the better the antimicrobial properties. Still, one has to be cautious as the higher the concentration the more likely it is to get a decrease in the flexural strength and modulus of elasticity of dentine. Sodium hypochlorite is ineffective in removing the smear layer (14,15). Chlorhexidine has a pH of 5.5-7 and due to its cationic charge, it binds the microbial cell membrane and makes it more permeable and can be considered as a broad spectrum anti-microbial agent (16).

At lower concentrations it is bacteriostatic but as the concentration increases it results in a bactericidal effect. It has no effect on the smear layer whatsoever.

Even though the ideal anti-bacterial agent is sodium hypochlorite, chlorhexidine is recommended to be used when the former irrigant is contra-indicated such as open apices, perforations and extensive resorptive cases (16,17).

EDTA (Ethylenediaminetetraacetic acid) is a strong chelating agent first introduced by Ferdinand Munz in 1935 and subsequently by Nygaard-Østby in 1957. It binds to calcium ions in dentine to form calcium chelates.

Ultrasonic activation of EDTA can increase dentine penetration but with the increased temperature of the ultrasonic waves the calcium binding capacity decreases. The indications are to use 17% EDTA for 1 minute in contact with the root canal wall (18).

Important points to take into consideration during each endodontic treatment:

- Sodium hypochlorite should be used as an irrigant after each and every file used throughout instrumentation
- 17% EDTA irrigation for 1 minute in contact with root canal walls prior to a final rinse of sodium hypochlorite
- Unless contra-indicated the final rinse prior to drying the canal should be with 2.5% sodium hypochlorite for 30 seconds.
- GP points should be soaked in sodium hypochlorite for at least 1 minute and then dried prior to obturating the root canal so as to disinfect them.

Different irrigation techniques and irrigant delivery devices have been proposed over time so as to improve the irrigant efficiency during endodontic treatment.

These include:

- a) Manual Dynamic Activation (MDA) – this technique reduces the vapour lock effect by facilitating gas bubble breakdown inside the root canal space. The apical instrument progression allows the irrigant to flow along the canal while allowing the vertical reciprocating motions to fill in all the voids in the root canal space. This movement leads to the formation of turbulence in the canal to allow the irrigant to flow in the root canal (21).
- b) Apical negative pressure – The irrigating material is delivered down to the apical third of the root canal through a negative pressure pulling down irrigant. Then the irrigant is drawn up by suction along the middle and coronal third of the canal (22).
- c) Sonic and ultrasonic irrigation – These types of irrigant delivery devices depend on

file oscillation, acoustic streaming and cavitation where a focus of energy leads to shockwave impulses that agitate the irrigant. The bubbles will rupture close to the root canal wall and a micro-acoustic current forms (23).

- d) Laser-activated irrigation – During this process irrigant vaporization leads to liquid expansion. During this expansion process voids in the irrigant will form. As the bubbles shrink, a high pressure will result in the surrounding fluid thus leading to the formation of an acoustic wave transmitted through the irrigant. Photon-induced photoacoustic streaming (PIPS) works with the same principle, but instead the tip of the delivery device is placed in root canal orifice. Sonic irrigation was then introduced by Chris Ruddle in 2007. Oscillations vary from 20–20,000 Hz leading to the agitation of the root canal irrigant (23).
- e) Other novel irrigant delivery systems have been proposed such as the self-adjusting system and photodynamic therapy. Still up till now the literature is still conflicting and most state that the latter techniques can be used as adjuncts rather than a substitute to the conventional irrigating systems.

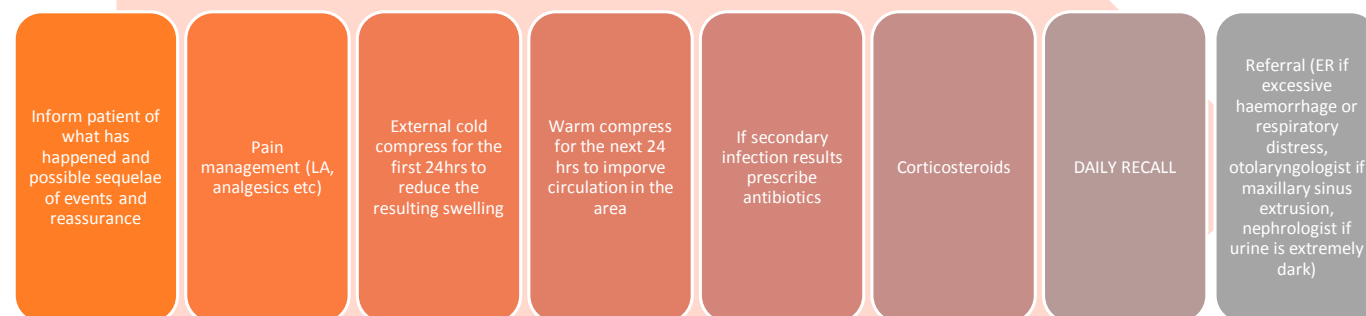
From all this one may conclude that root canal irrigation is actually a crucial part of endodontic treatment. Successful irrigation does not only rely on using an irrigant but to also use adequate delivery methods to improve the efficacy of the irrigation process. One must always keep in mind the properties of each and every irrigant used together with the different irrigating techniques available on the market to always aim to improve the efficacy of debridement and disinfection of the root canal space. 📖

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Treatment of an unwanted NaOCl extrusion incident

Dr Vincent Gauci

Dental Surgeon 30.06.1952—14.11.2023

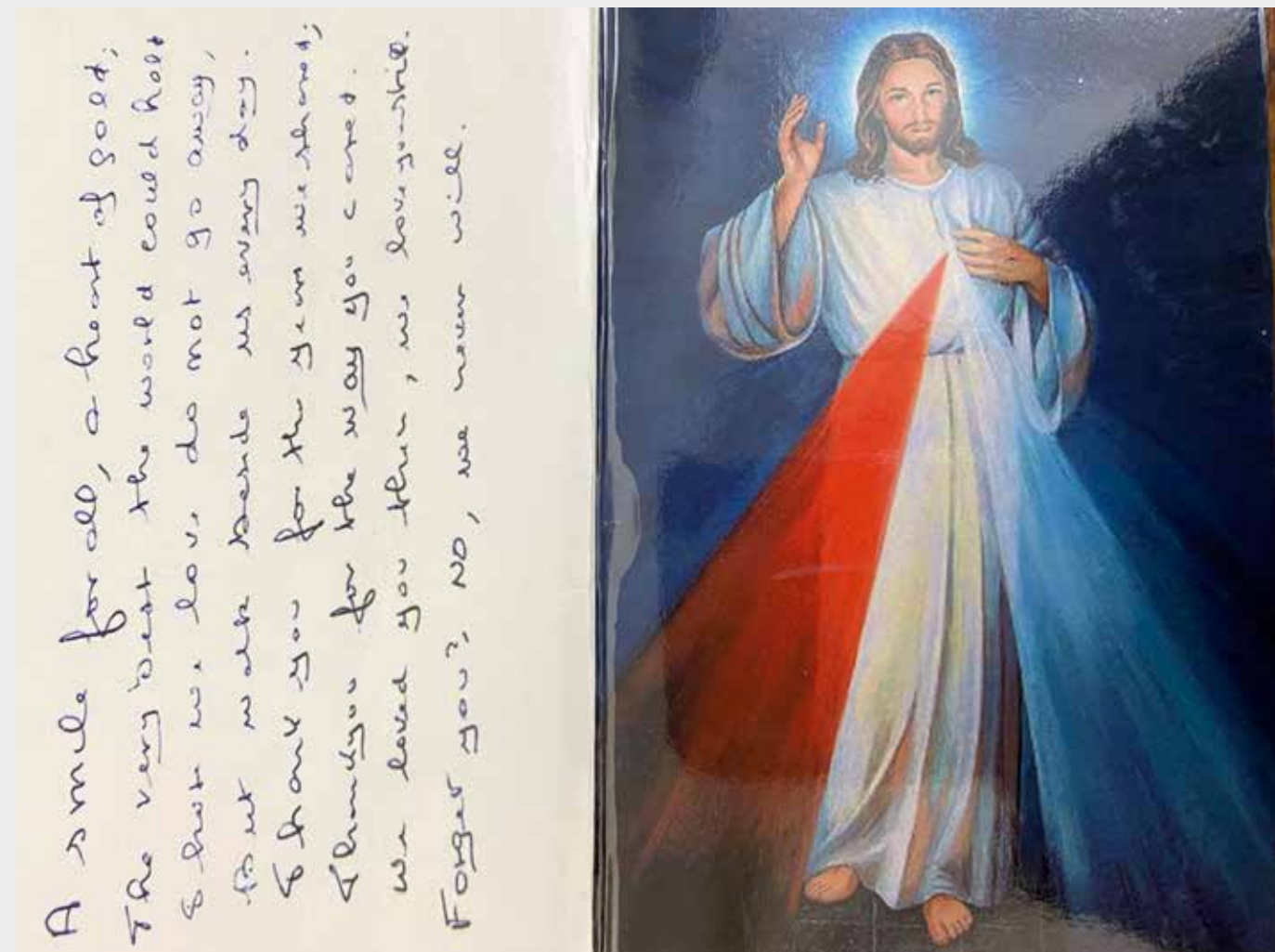
By Dr Tony Charles

I have known Vince since time immemorial. We were both born and lived our youth years in Birkirkara and his brother, the late Alfred, was my friend.

I renewed my friendship with Vince at University where we both graduated as dental surgeons though not in the same years. We both opened our dental surgeries in the South, we both married girls from the South and we both went to live in Marsaskala. We also have sons of the same age (Christian Gauci and Nicholas Charles) who are both dental surgeons.

I can write a very long obituary for Vince and it will not do justice to a gentleman who one remembers as a colleague. I remember him fondly as being a loving family man, a joy to have around, very proud of his wife Olivia, his three children (Christian, Dr Robert MD and Viola) and Gozo. Like me he was an avid reader of books and we shared and discussed our latest reading experiences.

Vince and Olivia always attended St Apollonia celebrations and next year we will miss Vince but we hope that Olivia will honour us with her presence.



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THE DAM CBCT COURSE RADIATION PHYSICS IN RELATION TO CBCT

A lecture by Professor Arthur Cortes DDS MSc PhD
MSc in Oral Diagnosis, ITI Fellow, Straumann User, Radiologist,
CbCT Reporter, Postdoctorate Fellow at Harvard University

Summary by Dr David Muscat

RADIATION FOLLOWS PHYSICS THEORY

X ray are accelerated electrons. The shorter the wavelength, the more energy. This energy is needed to cause ionisation. Removing electrons gives rise to ions and free radicals.

X rays have no charge. They travel at the speed of light. They travel in straight lines. They are harmful to tissues and cannot be focused to a point.

An electron hits another electron that is in the X ray device. The electron leaves the orbit but there is a release of radiation.

BRAKING RADIATION

The radiation given off by free electrons that are deflected (accelerated) in the electric fields of charged particles and the nuclei of atoms.

CHARACTERISTIC RADIATION

This occurs when the incoming electrons collide with the electrons within the heavy metal and knock-out the electrons from the electron shell.

In CBCT 85% is braking radiation. 15% is characteristic radiation.

An X ray beam can be modified by altering the beam. Factors controlling the x Ray beam of CBCT include:



- Timer (exposure duration)
- Exposure rate (in milliamperes 4,7,13)
- Energy KVp and filtration – mostly fixed adults/children
- Intensity (target-patient distance)

ADDITIONAL FACTORS OF CBCT

- Voxel size (the lower the size the better the quality of the image)
- Field of view (area you are scanning. If you go too high you are no longer within the radiological guidelines of Europe).
- Slice thickness
- BIT scale (proportional to your

contract resolution-.degrees of grey and white).this is a logarithmic scale. The higher the values-the higher the bone density.

- The contrast scale for CT scan.
- Pixel values=BIT scale. For soft tissue contrast only medical scans are used as there is no contrast resolution.

CBCT IMAGING ASPECTS

Contrast(you want a nice contrast scale)
Density (you want average)
Exposure time

Continues on page 31.



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THE DAM CBCT COURSE RADIATION PHYSICS IN RELATION TO CBCT

Continues from page 29.

This is directly proportional to the number of photons(X rays)generated at all images. (there is never one X ray).

The duration of the exposure and thus the number of photons generated. The quantity of radiation produced by the X ray tube id directly proportional to the tube current (mA) and the time the tube is operated.

TUBE VOLTAGE

This will give more energy to each electron . there is increased efficiency of conversion of electron energy into x ray photons and there is an increase in the number of photons generated thus meaning maximal energy.

INTENSITY

Target patient distance is inversely proportional to the square of the distance from the X ray source.

There is an interaction of the X ray with matter -as the beam goes through it is attenuated and decreases in density. Scattered X rays are bad fro CBCT scan. X ray photons are either absorbed or scattered or no interaction (9%).

COHERENT SCATTERING

About 7% but in newer machines 5% The excited electron returns to ground state and produces a scattered photon. This may damage the image. It happens more with CBCT than a medical CT. It may cause fog.

Photoelectric Absorption 23%
Compton Scattering 49%

RADIATION EFFECTS IN RELATION TO CBCT

Direct effects
Indirect effects – alter water molecules



creating H+ and OH- ions and the OH- creates damage in tissues.

IONISATION EFFECTS

Deterministic – lethal damage of DNA. Affects tissue or organ function. Mucositis, cataract caused by death of too many cells. There is a radiation dose threshold that is proportional to the dose. Below this minimum it will not happen. If the dose is double the mucositis will be twice as bad.

Types of deterministic effects are cellular, in tissues, systemic or from radiotherapy.

Cellular deterministic effects result in DNA damage and chromosomal alterations.

Cell death during mitosis.

The closer we are to the reproduction of cells the the damage is higher. Proliferative tissue is more affected. Apoptosis may be inducted. It may affect the surrounding cells.

CELL RADIOSENSITIVITY

High: epithelial basal cells, stem cells. Bone, oral mucosa
Medium: salivary glands, fibroblasts
Low: neural cells, muscles and erythrocytes

DETERMINISTIC EFFECTS ON TISSUES AND ORGANS

Short term: first days or weeks after exposure. Decrease in the number of proliferative cells

Long term: months or years, lost cells replicated by connective tissue.

Continues on page 32.



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THE DAM CBCT COURSE

RADIATION PHYSICS

IN RELATION TO CBCT

Continues from page 31.

RADIOTHERAPY IN ORAL TISSUE

Total dose 60-70 Gy
Areas – oral mucosa, teeth, bone, mucosa, papilla
Damage of basal cells. If there are no basal cells there will be no epithelial tissue.

ORAL MUCOSA

Basal cells mostly affected.
Inflammatory mucositis. Rupture between epithelium and connective tissue. Recovery 60m days after radiation. One may get a secondary Candida Albicans.

Tongue Papilla: sensitive, lose taste 2-3 weeks. Recovery 4 months.

Salivary Glands: mainly parotid, decrease in salivary flow, xerostomia. 1st week acute inflammation. 2nd month chronic inflammation. Recovery 6–12 months.

Teeth: Micodontia, tooth malformations, retarded rhizogenesis

Radiation Caries: Aggressive, increased concentration S. mutans, decrease in enamel remineralisation
Superficial lesions on Buccal and lingual aspects. Cervical lesions on cementum and dentine. Dark lesions on all the crown.
Treatment- sodium fluoride, OH, diet, treat xerostomia.

Bone Tissue: Decrease in periosteal vascularisation. Destruction of osteoblasts and osteoclasts. Osteoradionecrosis as no vascularisation.

Full Body Effects: Atom bomb. Medical radiotherapy.

CARCINOGENESIS



Damage to DNA. Severity not correlated to the dose. There is no radiation dose threshold. Organs vary in radio-sensitivity. Benefit must outweigh the risks - thus the dosage must be low.

RADIATION PROTECTION IN RELATION TO CBCT

1. X RAY Monitoring device worn by who operates
2. Pocket dosimeter.

Exposure absorbed disc (amount of energy impacted by radiation per mass) measured with grays.
1 rad= 10mGy
100 rad=1Gy
1 joule =1Gy

Equivalent dose Sievert

100 rem=1Sv
1 rem =10mSv

CLINICAL RELEVANCE

CBCT of maxilla and mandible gives a dose of 92.8 microsieverts measured in 1990. In 2007 this gave different measurement. The way of measuring is now different as nowadays there is better technology. Nowadays there is a smaller field of view. A full field of view – 182.1 microsieverts

If one only needs the mandible one can go down to a low field of view. E.g. endo, fracture. Proportional to the area of interest.
6cm mandible: 75.3 microsieverts
Maxilla: 36.5 microsieverts (when not using high resolution)
With high resolution up to

148.5 microsieverts but this is not needed in all cases.
13cms mandible and maxilla = 10.5 microsieverts
0.002 millisieverts =2 microsieverts

With an opg you have 0.003-0.024 millisieverts.

CBCT

Dento alveolar 19 microsieverts
Computer Tomograoh 28ms

CBCT

For implants use KV 75-120
The mA is optimised for each patient to reduce the dose. The field of view is matched to the clinical needs. A large voxel size consistent with clinical needs. Good software is important for proper image processing.

DENTAL RELATED FACTORS

Heavily restored
Pathology on adjacent teeth
Mandibular canal
Need a high level of detail

CORRECT CBCT INDICATIONS

If implant already placed- no need for CBCT. Use PA
Dental pathology -use PA or OPG
CBCT used for surgical planning

ALARA

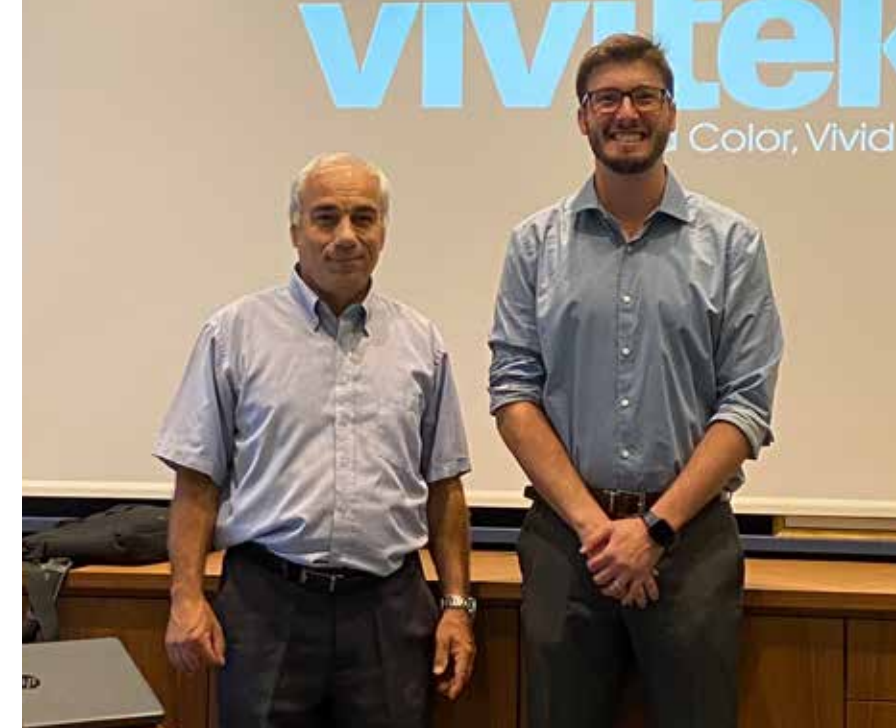
CBCT important as in many cases there is a concavity in the bone.

LEAD APRONS

For 2D
Used USA. In EU not required. However, one should cover thyroid and in cases pregnancy.

FOR CBCT

No longer required in USA but still required in south America. EU guidelines – no need to officially use lead apron and thyroid collar, but these are still protective measures.



CBCT EQUIPMENT

An X ray source creates a cloud of electrons which need to be accelerated so we need two power supplies. One heats the filament Tungsten – a metal with a lot of thermal and electrical conductivity. The metal has a coil around which there are electrons.

The second supply creates a voltage so you have a cathode and an anode. This goes to the second tungsten wire. The electrons will be removed from the layers and the x Rays are directed with a collimator. There is a tomographic (movement) around the patient. The oil cools it down. The outer parts are copper to contain the heat. Electrons travel in a vacuum at the speed of light.

Electrons emitted from cathode to a target in the anode- and produce X Rays.

X RAY TUBE CATHODE

Consist of a filament and cup. The filament is the source of electrons. The X ray source rotates around the patient and the sensor rotates at the same time.

With a CT (medical) there is a fan shaped beam.

With a CBCT (adapted for dentistry) there is a cone shaped x ray beam. A single rotation captures the entire area. There is a lower radiation dose as you rotate only once around the patient BUT you

will not get a good contrast as with CT. The one beam will also lead to more scattered radiation.

Nowadays you can have the CBCT and OPG in the same device. A digital panoramic, a digital cephalometric as well as a lateral projection.

TO PREPARE PATIENT FOR CBCT

Lead apron, lip retraction, get patient to stick tongue onto the hard palate for OPG and CBCT. A chin holder can be used for the bite. For soft tissue contract one may use a lip retractor.

A CBCT of a surgical guide can be used for I guided surgery. Raw images – DICOM files

1 FILE = 1 SLICE

Each file is an axial slice. One needs a cloud system to store your work. Do not use external hard drives.

JUSTIFICATION OF X RAYS

Must be justified on an individual patient basis by demonstrating that the benefit must outweigh the potential detriment.

No radiographs are taken unless one takes a history and performs a clinical examination. Bite Wings for caries are based on caries risk assessment

With paediatrics a periapical is enough. With trauma a CBCT may be used but this only detects fractures in 35% of cases..

For fractures one needs detail so take a Pa not an OPG. OPG has distortions. ■

PROTOCOL FOR IMPRESSIONS FOR ORTHODONTIC TREATMENTS WITH ALIGNERS



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INTRODUCTION

Over the past ten years, the use of addition silicone, especially polyvinyl siloxane (PVS), has increased as a material for precision impressions.

These materials are distributed in the form of two separate pastes (a base and a catalyst) which can be mixed in equal quantities by hand or by using automatic dual cartridge dispensers.

PVS have been obtained by chemically modifying condensation silicones. Both derive from a polydimethylsiloxane polymer; however, the presence of different terminal groups is the reason for their different hardening reaction. PVS deserve to be considered in a category of their own thanks to their better dimensional stability and different polymerisation reaction.

PVS are mainly used in the field of fixed and removable prostheses and in implant-prostheses. They more recently however have found application in the field of orthodontics, thanks to the introduction in the early 2000s of orthodontic treatments with aligners that make use of CAD-CAM technologies.

These treatments consist in the packaging of a sequence of thermoformed masks that each correspond to an orthodontic treatment step.

The need for high precision and stability impressions is due to the nature of the device, which must be as adherent as possible to the dental arch to best express the programmed motions, and also thanks to the operational procedure of the case preparation, which involves sending the patient's impressions across the ocean for virtual setup preparation.

Thanks to these characteristics, PVS have found wide application in this sector.

Below is an illustration of a PVS use technique for the taking of impressions and bite in a case for which an orthodontic treatment with aligners has been provided.

PREPARATION OF THE MATERIAL

The instrumentation for taking impressions to be sent to start a case using this method is as follows:

- Plastic disposable upper impression tray (often provided by the company that will develop the masks)

- Plastic disposable lower impression tray (often provided by the company that will develop the masks)
- Elite HD+ Putty
- Elite HD+ Light
- Occlufast Rock
- Dispenser D2
- Clear film
- Latex-free gloves

STEP 1

Use doses equivalent to 1 full measuring cup of Putty Elite HD+ Base and 1 full measuring cup of Putty Elite HD+ Catalyst.

Technicians must wear latex-free (Vinyl or Nitrile) or latex gloves that are certified for use with PVS to mix the Putty silicone as commonly used latex may interfere with the polymerisation reaction of the material. (Fig. 1)

Mix the two components with your fingers with a kneading movement until there are no more recognisable streaks or residues of either of the two components. (Figs. 2-3-4)

Then place the material on the disposable impression tray pro-

vided and/or recommended by the mask manufacturer, following the shape of the dental arch.

Using your thumbs, mould the material in the distal area following the last molar, creating a valley and a distal wall to improve the impression of the distal wall at the end molar. (Figs. 5-6)

Position the previously cut clear film sheet on the impression tray, making sure that it adheres uniformly to the material without crumpling. (Fig. 7)

Extraoral processing time of material 1:30 min.

Position the spoon in the patient's mouth, making sure that all its parts fit correctly and stopping before touching teeth with the bottom of the impression tray. Keep the impression in place with the index fingers of both hands for 2:30 minutes, then remove.

Remove the clear film after the impression has been removed from the oral cavity. (Fig. 8)

STEP 1 - ALTERNATIVE

If clear film is not available, the putty impression can be performed by keeping it for 1:30 min inside the oral cavity. Then remove it and, taking advantage of the residual degree of malleability of the Putty silicone, when the interproximal septa has flattened, make use of a college clamp. (Figs. 9-10)

STEP 2

Dry all of the impression parts using an air syringe. (Fig. 11) Attach the disposable tip to the Elite HD+ Light cartridge previously loaded on the Dispenser D2.

If you need to use a new cartridge, before loading the impression tray spoon, it is advisable to drain the initial part of material from the cartridge to make sure any impurities or excess of either of the two components are eliminated from the mixture. (Fig. 12)

Continues on page 36.



Preparation of the material (Figs. 5-6)



Step 1



Fig. 1



Fig. 2



Fig. 3

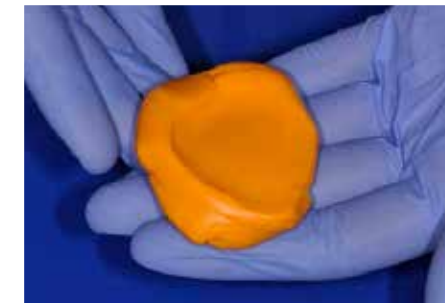


Fig. 4

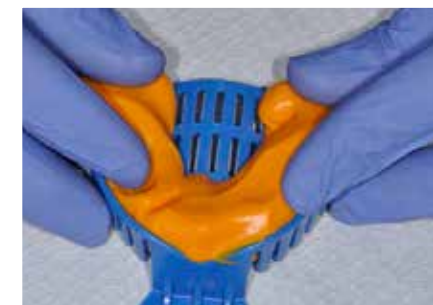


Fig. 5



Fig. 6



Fig. 7



Fig. 8

PROTOCOL FOR IMPRESSIONS FOR ORTHODONTIC TREATMENTS WITH ALIGNERS

Continues from page 35.

Load the spoon starting from one of the two molar areas and following the shape of the arch, always keeping the tip immersed in the material so as not to incorporate air bubbles. (Figs. 13-14) Extraoral processing time 1:30.

Position the spoon in the patient's mouth, making sure that all its parts fit correctly. Keep the impression in place with the index fingers of both hands for 2:30 minutes, then remove. Verify that there are no bubbles or distortions on the impression and that the impression tray is not visible at any point inside it. (Fig. 15)

STEP 3 - OCCLUSION IMPRESSIONS

Attach the disposable tip to the Occlufast Rock cartridge previously loaded on the Dispenser D2. (Fig. 16)

Ask the patient to tighten his teeth in normal occlusion, after taking some tests to avoid mandibular slipping.

Inject Occlufast Rock starting from one of the two molar areas and following the shape of the arch, always keeping the tip immersed in the material so as not to incorporate air bubbles. (Fig. 17)

Make sure that the pc keeps stable occlusion until the material has fully hardened (<60sec), then remove it. (Figs. 18-19).



Fig. 9



Fig. 10

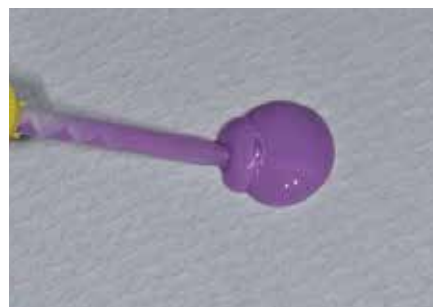


Fig. 12



Fig. 14



Fig. 16



Fig. 18



Fig. 11



Fig. 13

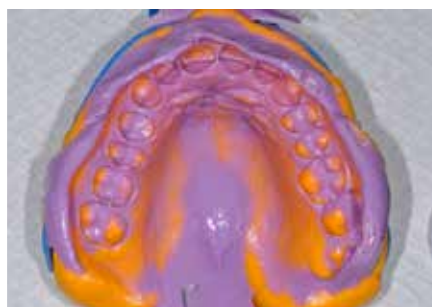


Fig. 15



Fig. 17



Fig. 19

THE HANDS-ON DAM HILTON CBCT COURSE IN CONJUNCTION WITH UoM

A lecture by Professor Arthur Cortes DDS MSc PhD

Summary by Dr David Muscat

A CBCT procedure is a 3D cone/pyramid shaped divergent X ray beam directed through the patient onto a detector. The X ray generator and detector rotate around the patients head. The scan time can be as fast as 5 to 20 seconds.

Most CBCT units have a small 'footprint' enabling office placement. The patients head must be immobilised for a good final image. All CBCT images need to be reported eg .if the maxillary sinus is in the field of view, all the volume needs to be reported on.

This was adapted for dentistry. The tongue must touch the roof of the mouth to avoid airspace. Use a lip retractor if possible. The end result is a 3D visualisation of the oral and maxillary complex from any plane.

A stock of 360 images or exposures compiled into a volumetric dataset through a computer process known as primary reconstruction. The data volume is then converted by accompanying software.

This can be viewed as:

- 2D Transaxial (cross sectional)
- Parasagittal (multiplanar reformatted or multiplanar reconstructed MPR)

3D techniques such as surface reconstruction and volume rendering. A combination 2D and 3D techniques. DICOM files of the CBCT can be exported to a file hat you can £D print or mill with a milling device.

VOLUME RENDERING

A reconstruction of the entire volume with the information. Some layers can be removed to see what is inside.eg surgical planning. One can see exactly the location of a lesion. Eg. One can remove an alveolar crest and plan surgery. You



first start with the axial plane and then do a 3D rendering. Some have a lower field of view but have less detail.

COMPUTERISED TOMOGRAPHY

Advantage: No magnification or distortion. Pixels turn into voxels. Voxels are the smallest 3D components of an image. One estimates bone density by means of analysis of pixel values. Raw images are reconstructed in different plans and as 3D models.

OPTIONS

Trauma need a soft tissue contrast – medical CT. A CBCT does not give any soft tissue contrast .It only gives soft tissue contours. One cannot differentiate between soft tissue and epithelium. One must choose the field of view wisely. For most case use 5x5. For dental arches 8x8.

CHOOSE A SOFTWARE

THE CBCT comes with DICOM software. Radiology software works with DICOM files .all axis must be parallel or perpendicular to our structure. There are artefacts from metal .an effect of scattering and back projection. Looks like bone loss around an implant. Estimate bone density mesial and distal and buccal to lingual. It is important to rotate a plane to detect a dilaceration. One needs a Dicom

view which is then converted to apical. We do not see nerves- only canals.

For a third molar one can use axial, sagittal and coronal planes. But you need to tilt the sagittal parallel to your arch. You need to diagnose all your axis towards the problem. Tilt the axis parallel to the mesial root and then diagnose the distal root. E.g. thinning of the alveolar crest . in the axial plane see bucco-lingual extension plus lateral medial extension and AP or BL extension of the lesion.

PARASAGITTAL – see thinning of the lingual plate and other relationships.eg if there is bone between a cyst and ID canal so plan an enucleation – remove the whole epithelium. With parasagittal image one can see roots and the lingual plate relationships. Risk of parasthesia.

One can use the CORONAL PLANE to compare both maxillary sinuses. The TRANSAXIAL PLANE is used for BL assessment on the alveolar ridge.(or parasagittal). An axial plane is transverse. The CORONAL PLANE is good for sinus lift procedures and it slices through anatomy from side to side.

Continues on page 38.

THE HANDS-ON DAM HILTON CBCT COURSE

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The SAGITTAL PLANE is used the least. This is a slice through anatomy from front to back, and you only see parts of things, so it is not the best for dentistry. It can also be rarely used to see a AP extension such as a maxillary torus where one can see the entire shape. The most important are the PARASAGITTALS as they can show the distance from anatomical structures. A series of cross sectionals/transaxials. The cross section of an area can be developed with 0.5 to 5mm spacing between images. For 3D we need to rotate.

ALARA INDICATIONS OF CBCT

Infections, osteomyelitis, cysts, benign and malignant tumours, trauma in maxillo facial region, lesions involving bone. The 3D CT has been applied to trauma and Craniofacial reconstructive surgery and used for the treatment of congenital and acquired deformities. If a cyst is intact it will not recede after root canal treatment. You need 3D information.

OTHERS

- Dental Implant planning and guidance
- Impacted Teeth
- Image Guided Surgery – ID Canal, Submandibular Fossa, Ant. L Fossa, Nasopalatine Canal, Canalis Sinuosis, Max Sinus, Tuberosity Of The Maxilla

A normal slice thickness of CBCT device is 0.8mm.

TMJ

You cannot see a disc displacement- you need an MRI. Close and open you will see the disc displacement. For CONDYLEs you start with the axial view- you see this at the maxillary level. Bring all the axis to be parallel or perpendicular to the condyle.

IMPACTED TEETH – Use mandibular canal mapping. For an Ortho assessment one can use an OPG

CBCT ANATOMY ORTHAGONAL PLANES

- Condylar head
- Mastoid air cells
- Cervical vertebrae

- NP airway
- Max sinus
- Nasal septum
- Nasal conchae
- MB plate
- LP plate
- Coronoid process
- Soft tissue of nose
- Mesial arch
- anterior teeth
- Posterior teeth
- NP airway
- C vertebrae

A fracture is detected by a lack of continuity of the cortical plate. It is detected using the soft tissue window.

IMPORTANT

If the L and B plates are not at the same level this is not an artefact. Bubbles inside the scan are blood – internal bleeding. Window levelling can be used to increase the contrast. For a fracture of the ramus use the coronal plane. The CBCT can be used for a fracture of the frontal bone involving the roof of the orbit- you need to navigate the image.

PATHOLOGIES OF THE MAXILLARY SINUS

- Antral pseudocyst -diagnosis purely radiographic
- Mucocele -can be invasive
- Sinus floor failures
- Is the lesion contained by the maxillary sinus walls or has it invaded into the other space? This needs more attention.
- An acute inflammation in the sinus is flat as it is liquid.

OPACIFICATION OF MAXILLARY SINUS

Sagittal plane: Navigate through coronal plane. Navigate ostium to check nasal cavity. With MUCOCELE-plate expansion. The isodensity of a mucocele- increment of pressure in the sinus. If a patient is edentulous you have sinus membrane thickening. the alveolar crest is also resorbed so there is a failure of the sinus floor. (so you would need to use collagen membrane). It is important to measure distances of lesions from the plates. The Odontogenic keratocyst and the ameloblastoma differ.

If a lesion is close to the lingual plate one needs to be careful fo

the lingual artery. One needs to know the relationship between the alveolar crest and impacted teeth.

CLEFT PALATE

One needs to know the volume assessment of the area without bone.

CYSTS - THESE ARE MORE CORTICATED.

In CBCT all limits are seen. Cysts and granulomas can be confirmed. The AXIAL PLANE never lies. It is always in the same place. Press reset and the axial plane will be in the right place.

Odontogenic keratocyst – CBCT or median ct for a soft tissue contrast- medial pterygoid muscle, lateral pterygoid muscle, masseter. Ameloblastoma -beach ball, multilocular. ‘Soap bubble’ appearance. On the CBCT you will see bone inside the lesion and the lesion grows in such a way that bone is trapped. It is usually more round and is more BL rather than MD in its expansion. MIXOMA – mesenchymal in origin so more bone is trapped and creates angles’, a tennis racket ‘appearance.

GIANT CELL GRANULOMA – MULTILOCULAR FAST GROWING LESION

CHERUBISM -aggressive, young patient MALIGNANT TUMOUR - serrated, elevated borders, hard borders Eg osteosarcoma on CBCT -a pattern of ‘sunburst’. resorption of buccal plate. A moth eaten resorption. Quick resorption of bone. There is a periosteal reaction and fast expansion.

GUNSHOT WOUNDS

Use CBCT to plan excision of bullet.

SEQUESTRAE of osteonecrosis seen on CBCT- one needs to open a flap/debridement with pressure and create bleeding points.

Small scans are better for bone defects. Software uses different colours for different bone levels eg. yellow, red, black. You can estimate bone density with CBCT. Measure by finding the true pixel values. With the mouse for brightness you go up and down and for contrast you go left to right. 🖱️

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