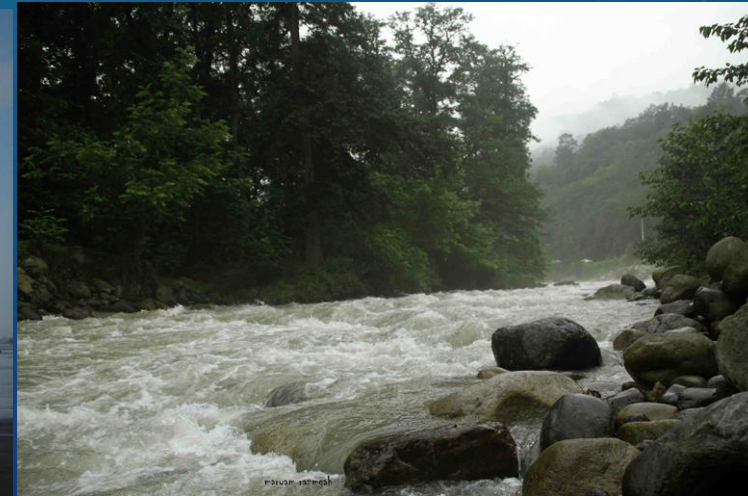
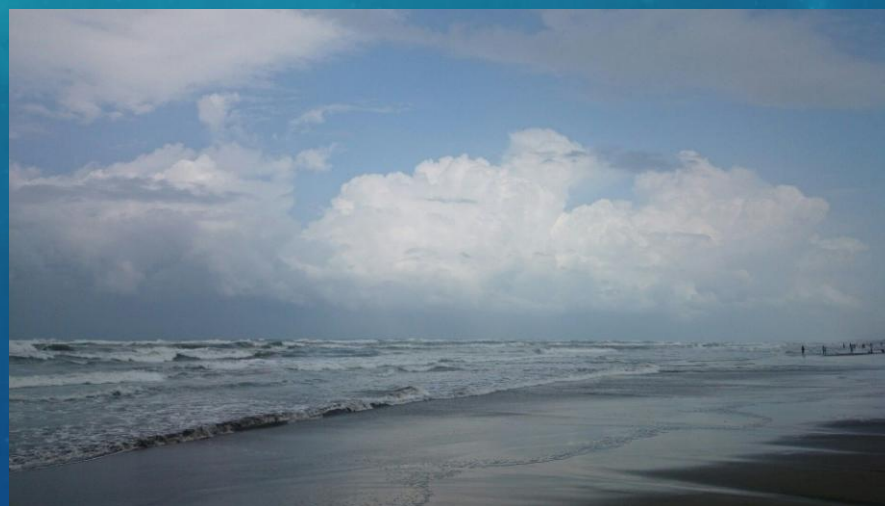
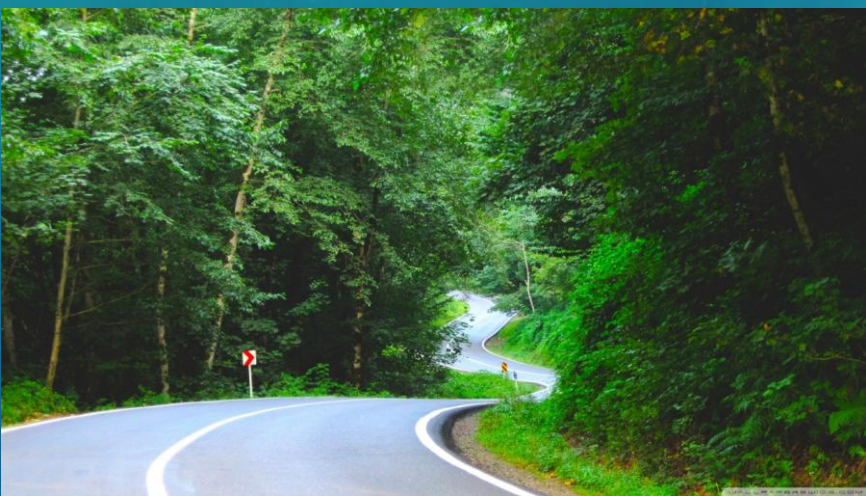




IN THE NAME OF GOD



IMAGING FINDINGS OF MAXILLOFACIAL MUCORMYCOSIS

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Respectful thanks

Department of Maxillofacial Surgery, Guilan University of Medical Sciences
Dr Motevasseli, Dr Nazarpour, Dr Sigaroudi, Dr Abdi, Dr Hosseini, Dr Pourarz,
All of the residents, Healthcare Unit workers
Department of Maxillofacial Radiology
Department of Infectious disease



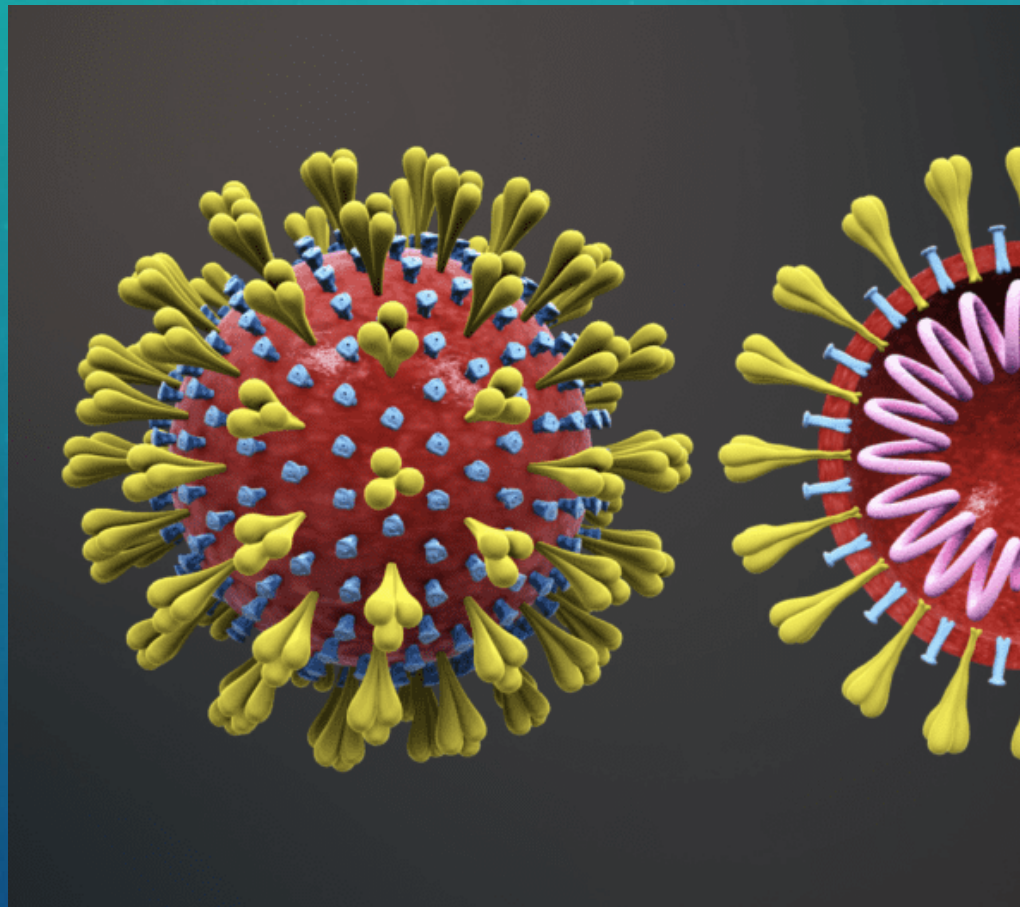
MUCORMYCOSIS

- Mucormycosis is a fatal and opportunistic infection with high morbidity and mortality
- Among the different clinical forms of disease, ROC is the most common
- ROC starts through inhalation of spores and extends into the PNS, Orbits, and cranium by angioinvasive property and dissemination through the vascular channel
- Purulent arteritis and vascular thrombosis lead to infarction of surrounding tissues

PREDISPOSING FACTORS

- -Diabetes Mellitus
- -Immunocompromised condition (steroid, AIDS ,..)
- - Iron overload
- - Hematological malignancy
- Renal and liver diseases
- Covid 19- associated M

Ambereen A et al, Clin Infect Pract. 2021 Nov; 12: 100099. doi: 10.1016/j.clinpr.2021.100099



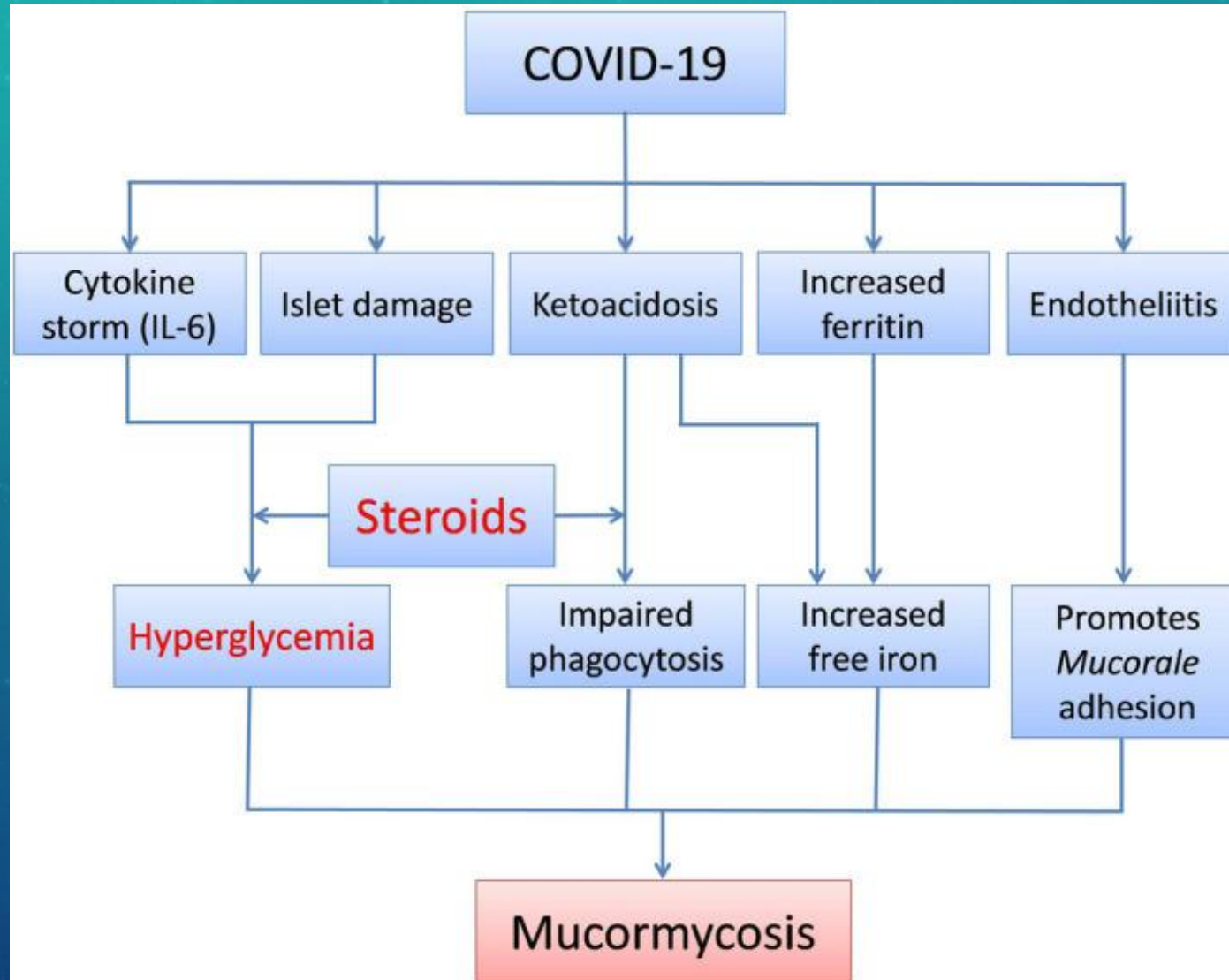


COVID 19- ASSOCIATED MUCORMYCOSIS (CAM)

COVID-19 can be directly **responsible** for other factors (immune system dysregulation, coagulopathy and raised serum iron level that induces endothelial damage) that encourage fungal proliferation . Furthermore **steroids** (higher dose and duration) as a part of treatment of COVID infection exacerbate diabetes and ketoacidosis
Another reason for association between covid and mucormycosis is the dissemination of fungal spores via **water used in oxygen humidifiers**.

Pal et al.

Mycoses. 2021 Dec;64(12):1452-1459



- Mortality rate between 50 to 80%
- Prognosis depends on early diagnosis, Surgery, and antifungal therapy

SIGN AND SYMPTOMS OF CAM

- Facial pain
- skin or mucosa discoloration
- Swelling
- Pus discharge
- Proptosis
- Pansinusitis
- tooth pain
- tooth mobility
- Palatal swelling or ulceration

Post-covid osteomyelitis

Shirke et al. DOI:10.13140/RG.2.2.25350.70725

GROSS SURGICAL FINDINGS

- Necrotic and cheese-like texture of medullary bone
- Fragile and thrombosed neurovascular bundle such as inferior alveolar canal





The initial symptoms of may be mistaken for tooth related pathologies so the patient might lose the precious time for treatment of fungal infection.

Max sinus mucormycosis has a high mortality rate of 46%

GRADE	SYMPTOMS	CLINICAL FINDINGS	CBCT FINDINGS	TESTS	PROPOSED TREATMENT
Grade 1 Maxillary sinus-unilateral or bilateral with nasal and soft tissue involvement	Nasal stuffiness, ulceration, foul smell, bloody or sticky discharge.	Nasal inflammation, localised ulceration in the perinasal area, philtrum, and lips can be seen. Or discoloration, ischemia, or eschar of the skin and or mucosa. Nasal discharge seen	Involvement of maxillary sinus with mild or no any changes in alveolar bone	Diagnostic nasal endoscopy KOH wet mounts	Surgical removal of any ulcers Referral to ENT for early endoscopic debridement of the maxillary sinus with systemic therapy of antifungals
Grade 2 Localised or unilateral maxilla &/or nose + maxillary + ethmoid sinus	Symptoms in grade 1+ Pain, headache, swelling on face, discharge from palate, gums, localised mobile teeth.	Intraoral or extraoral swelling. Intraoral- draining sinuses, localised ulceration, localised exposed necrotic bone. Nasal discharge - mucoid, purulent, haemorrhagic.	Osteolytic changes in maxilla (unilateral or localised) and/or nasal turbinates, septum, etc. along with opacification of unilateral or bilateral maxillary or ethmoid sinuses.	Diagnostic nasal endoscopy KOH wet mounts	Surgical debridement of affected bone and sinuses with systemic therapy of antifungals
Grade 3 Maxilla + nose + all paranasal sinuses with or without orbital involvement.	Symptoms in grade 1+ 2+ Pain++, Swelling ++, Bony necrosis ++, multiple mobile teeth. Proptosis, inflammation of eyes	Multiple intraoral draining sinuses, large ulcers, eschars, segmental mobility. Ophthalmic - ecchymosis, ophthalmoplegia Nasal discharge - mucoid, purulent, haemorrhagic.	Advanced osteolytic changes in maxilla, nose, walls of sinuses, zygoma. Opacification of all paranasal sinuses-unilateral or bilateral.	Contrast enhanced MRI, KOH wet mounts	Surgical debridement of affected bone and sinuses with systemic therapy of antifungals

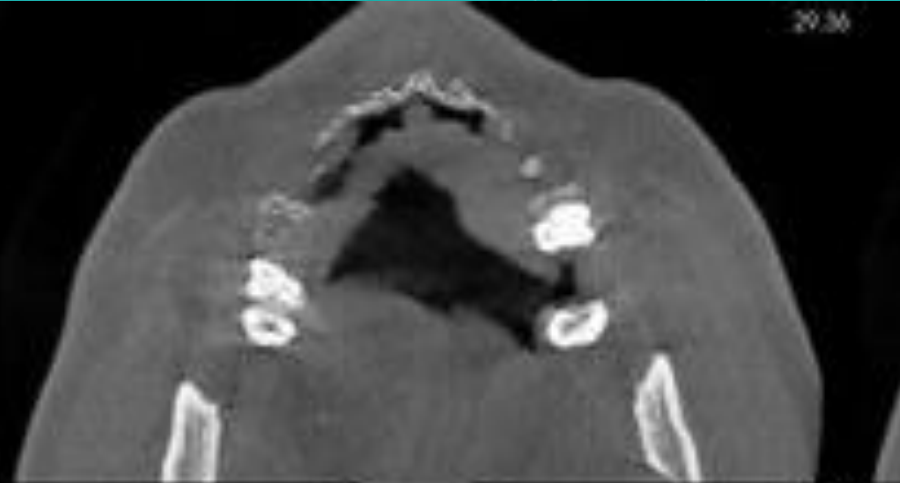
Muley, Pooja and Chitguppi, Rajeev and Jambure, Rajesh, Proposal for a Novel Grading System for Rhino-Maxillary Mucormycosis Based on the Analysis of 30 Cases (May 27, 2021). Available at SSRN: <https://ssrn.com/abstract=3854282> or <http://d>

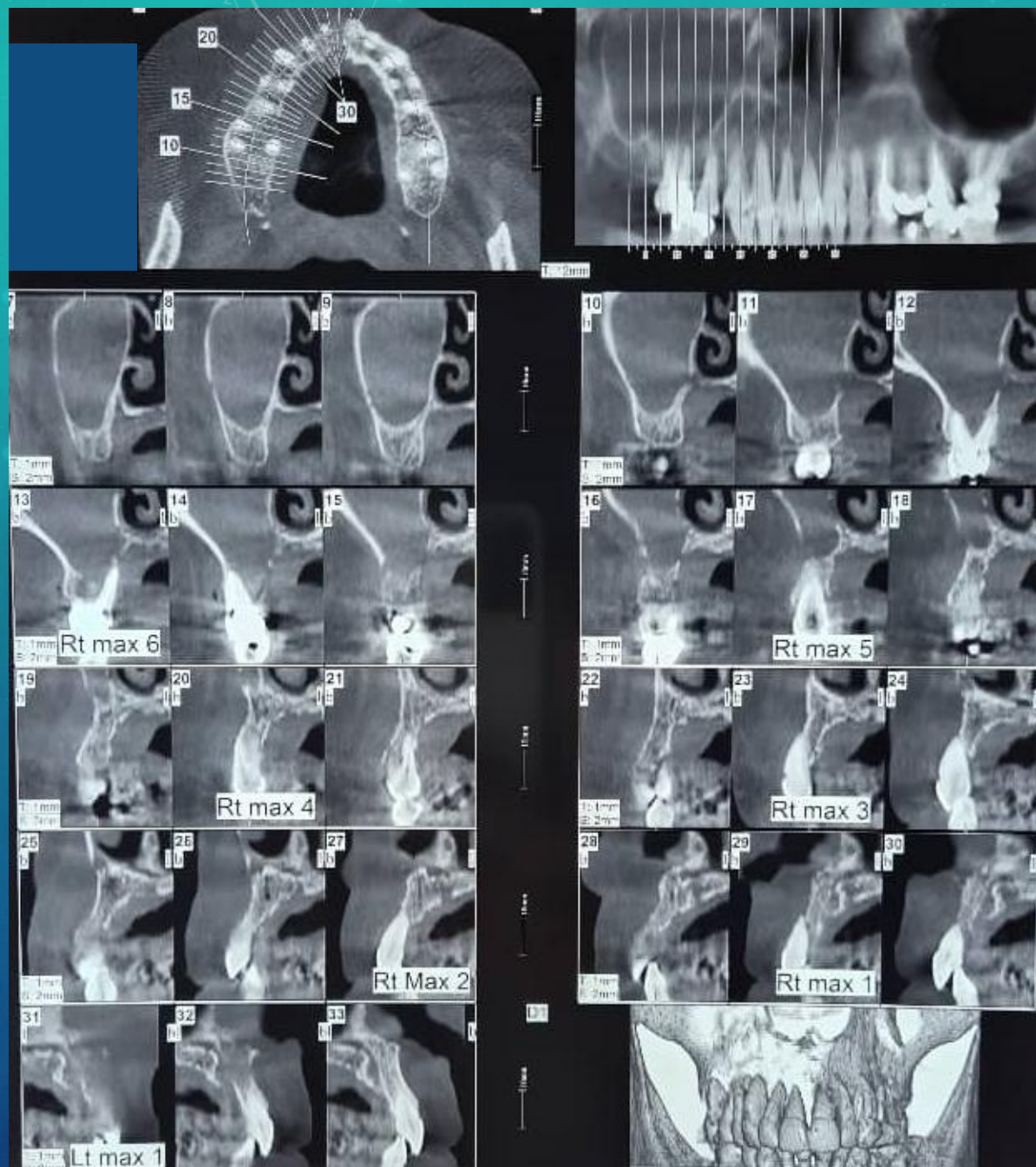
Imaging Findings

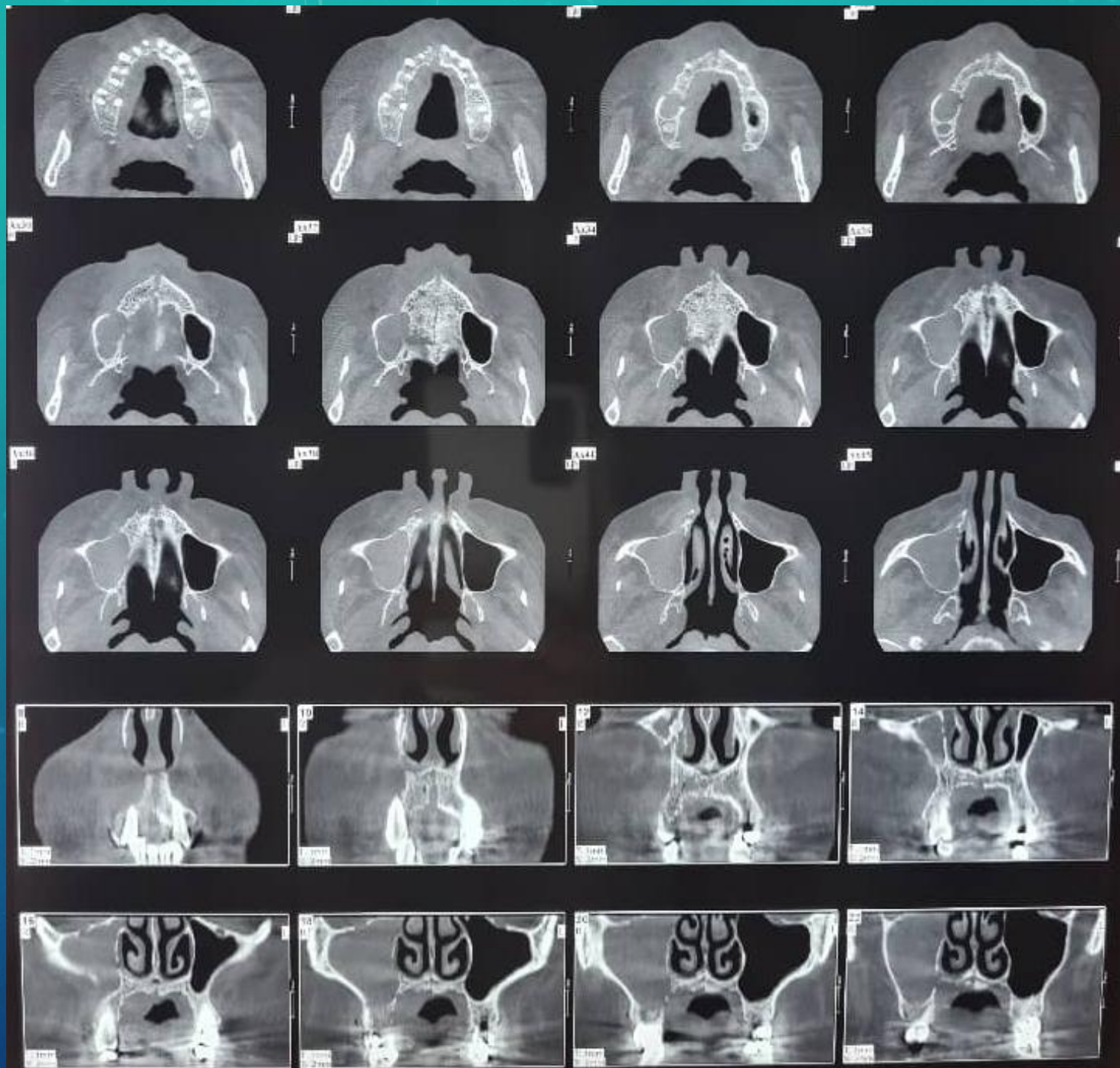
CT or CBCT findings

- Bone hypodensity
- Breach and erosion of cortical boundary of maxilla , palatal bone , PNS walls, orbital floor , ..
- Bone destruction looks like the malignancy
- Mucosal thickening and haziness of paranasal sinuses

*Gupta D et al. Pan African Medical Journal. 2021;39:183.
[doi: [10.11604/pamj.2021.39.183.30479](https://doi.org/10.11604/pamj.2021.39.183.30479)]*

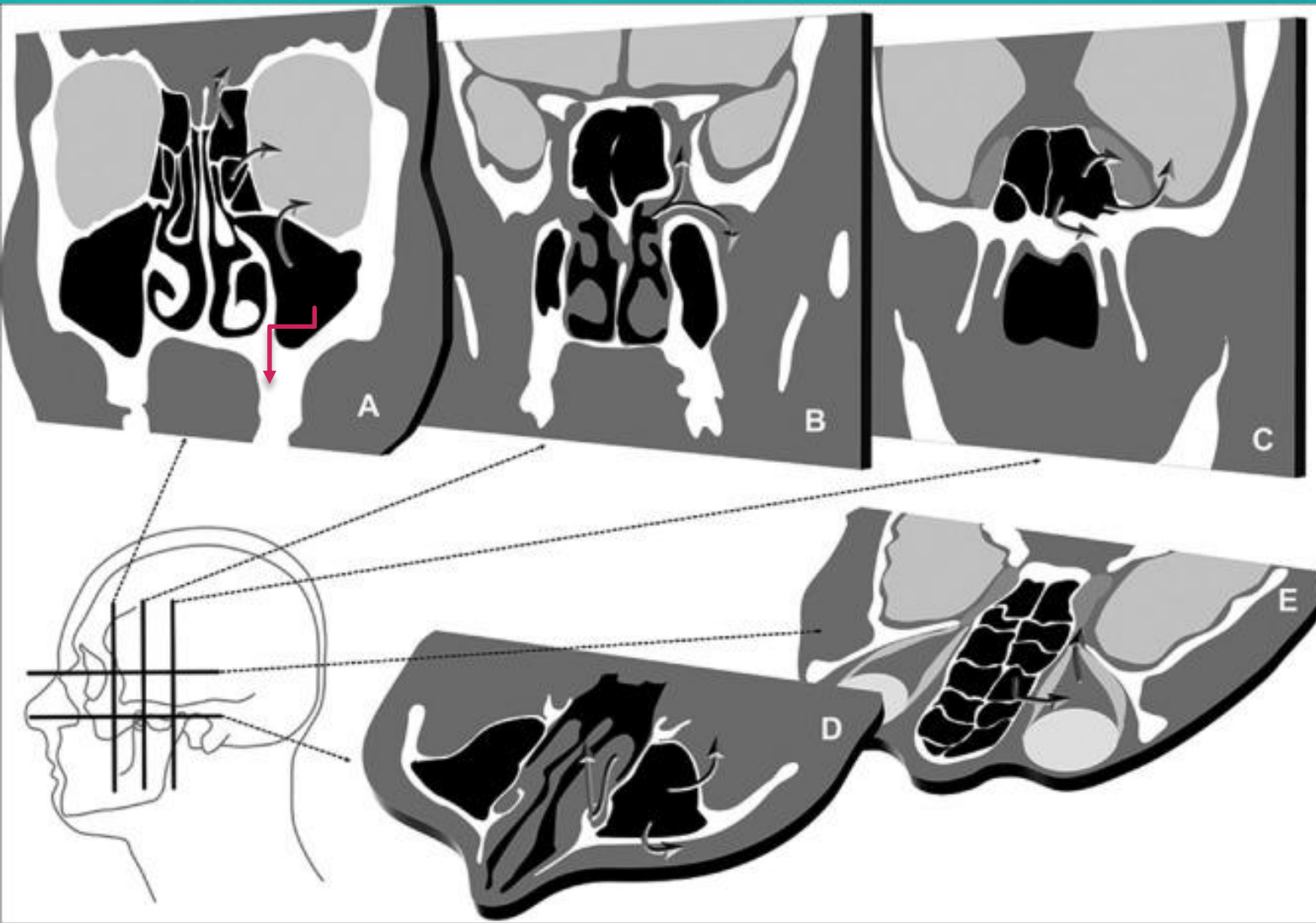






Note



Patchy radiolucency, and sinus obliteration in post covid patient with pain should alert the dentist to the possibility of fungal osteomyelitis







Path of spread in RCM

Pathways of spread in rhinoorbital cerebral mucormycosis. Direct spread from the ethmoid and maxillary sinuses into the orbit or intracranial compartment (a). Pterygopalatine fossa is a cross roads at the skull base, where nasal pathology may spread into the infratemporal fossa and cavernous sinus (b). Sphenoid sinus disease may extend into the cavernous sinus, brain, and skull base (c). Maxillary sinus disease may extend into the facial and retroantral soft tissue and along the nasolacrimal duct (d). Intraorbital disease may spread into the orbital apex and cavernous sinus (e)

	Type of study	Number of cases	Number of post covidpts	Clinical findings	Number of pts with involvement of jaw bone	Image findings
Mehta S et al 2020	Case report	1	1	Bilateral lid edema	1	MRI :Mucosal thickening of maxillary and ethmoid sinus, soft tissue mass with hyper-intensity on T2-weighted and FLAIR
Mekonnen K et al 2020	Case report	1	1	Edema, proptosis, eye redness, chemosis, fixed pupil	1	CT angiography : Extensive opacification of PNS, asymmetry and fat striation of retrobulbar tissues,
Ahmadkia K et al 2021	Case report	1	0	Toothache ,headache, ear pain, nasal congestion, unilateral facial swelling		CT : Mucosal thickening in maxillary sinus
Sharma K et al 2021	Case report	2	2	Facial pain, facial numbness, high grade fever, periorbital swelling facial redness	0	MRI : Orbital cellulitis, pansinusitis, abnormal signal in premaxillary skin, <u>retroantral</u> fat and masticator space extending to the right cavernous sinus, inferior turbinate and paranasal sinuses had non enhancing areas on postcontrast MRI T1w FS post contrast image in coronal plane demonstrates peripheral enhancement with central liquified non-enhancing collection along mandibular nerve passing through foramen oval
Raghu R et al 2021	Case report	1	1	Right side facial swelling gradually progressive loss of vision, occasional epistaxis with black discharge, unable to open eye due to edema, ecchymosis, absence of light reflex and extra ocular movement, black scar on	1	CT : Lamina papyracea dehiscence ,extra <u>conal</u> air pockets in right orbit, significant <u>intraorbital</u> fat standing, bulky inferior and medial recti and inferior oblique muscles, proptosis, sinus opacification

				hard palate, black crust in right inferior meatus		
Misra SR et al 2021	Case report	1	1	Ulcer in palate, exposure of bone, oro-antral communication, febrile, dyspnea, nasal stiffness, exposure of maxillary bone covered with necrotic slough, indurated and not tender in palpation	1	CT: Non enhancing soft tissue density in sphenoidal, ethmoidal and frontal sinuses, obliteration of osteomeatal openings
Rajasekaran S et al. 2021	Case series and review of literature	5	0	Periorbital edema, diplopia, necrotic black scar tissue in right side, silvery white margin, paresthesia of lower lip, proptosis	4	CT: Obliteration of maxillary sinus and thickening of sinus wall
Alamin MA 2021	Case report	1	1	Eye pain, ptosis, complete loss of vision, ophthalmoplegia, complete paralysis of extra and intraocular muscles, ptosis, dilated fixed pupil, severe pain and tenderness around periorbital area	0	CT: Partial opacification of ethmoid, maxillary, right frontal sinus mucosal thickening and retained secretions MRI: T1 weighted enhancement at periorbital area (periorbital cellulitis)
Ambereen A 2021	Case report and review of literature	1	1	Pain in lower back teeth, diffuse edema and tenderness on mandibular body and submandibular region, reduced mouth opening, multiple draining sinuses and inflamed gingival	1 	CT: Bone erosion with multiple air foci and hypodense collection in marrow cavity of mandibular ramus and body
Rajeev Joshi A 2021	Case series	25	25			CT: Maxillary sinus involvement, involvement of ethmoid air cells, frontal sinus, sphenoidal sinus, bony erosion of walls of sinus, air foci in bony structures T2: hyperintense sinus content with enhancing mucosal thickening 

Kumar A 2021	Case report	1	1	Unilateral pain and swelling, moderate pain which aggravated on bending head and chewing food, nasal congestion and headache on the same side, fever, purulent discharge, paresthesia, foul odor, necrotic bone in maxillary region .mobility of maxillary molars and edematous soft tissue	1	CT: Haziness in right maxillary sinus with erosion in lateral sinus wall 
Anita, Kumar S 2021	Case series	3	2	Swelling, ptosis, fever, headache, jaw ache during chewing, bloody mixed nasal discharge	0	CT and MRI: Mucosal thickening in maxillary and sphenoidal sinus Maxillary sinus filled with fluid and soft tissue associated with pre- maxillary subcutaneous fat stranding and retroconal fat stranding, mucosal thickening of ethmoid and maxillary sinus
Prajwal K 2021	Case report	2	2	One sided Swelling in middle third of face, pus discharge from upper teeth, mild proptosis, ptosis, denuded necrotic alveolar bone, segmental mobility	2	CT: Erosion of superior alveolus anterior aspect of hard palate anterior and lateral walls of the maxillary sinus extending to left orbit including zygoma, lesser and greater wings of sphenoid and pterygoid plates 
Palou E.Y 2021	Case report	1	1	Headache, diplopia, one sided decreased visual acuity, amaurosis, periorbital cellulitis	1	CT: Edema of soft tissues, mucosal thickening, destruction of turbinate, occupation of sinus, destruction of maxillary bone and floor of orbit, inflammatory changes involving orbit
Saidha PK et al. 2021	Case series	6	6	Pus discharge from gums, loose teeth, facial pain and swelling, headache, numbness, foul odor	6	Non-contrast CT: Hyperdense mass and heterogeneous opacification of max sinus, erosion of medial wall of maxillary sinus, involvement of ethmoid sinus, obliteration of PNS
Venugopal A. et al 2021	Case report	1	1	Palatal lesion, severe radiating pain, halitosis	1	No radiography report

Bonates P. et al 2021	Case report	1	1	Infection and necrosis of orbit and palate, papillary opacity	1	CT: Infiltration of maxillary and ethmoid sinus
Nelwan EJ 2021	Case report	1	1	Pain, swelling, congestion of nose, greenish discharge	1	CT: Soft tissue lesion on anterior nasal cavity, fistulation and ulceration of nasal surface, cutaneous thickening of palpebral lesion
Sai Krishna D. et al 2021	Case report	2	2	Pain and swelling in midface area, facial asymmetry	2	CT: Aggressive fungal osteolytic lesion 
Eswaran S. et al 2021	Case report	2	2	Facial paresthesia, bilateral ptosis and chemosis	2	CT: Invasive fungal sinusitis, Mixed lytic/sclerotic areas in frontal, sphenoid and ethmoid sinuses mild thickening of recti muscles, subtle MRI: retrobulbar fat standing
Bayram N. et al 2021	Case series	19	19	Orbital pain, ptosis, ophthalmoplegia, decreased vision	19	CT : Opacification of ethmoidal and maxillary sinuses, regarding bone destruction MRI: Multiple sinus syndrome, orbital apex involvement, intracranial involvement
Garg R. et al 2021	Case series	10	10	Headache, pain, nasal discharge, diminished vision	10	CT: Fungal loose mass in sinuses, mucosal thickening MRI : fluid collection
Shakir M. et al 2021	Case report	1	1	Black lesion on cheek, eye swelling, proptosis	1	CT : Soft tissue thickening MRI: T2 hypersignal infratemporal region, diffused restriction areas of cerebellum and pons (acute infarct)
Baskar H. et al 2021	Case report	1	1	Cough, fever, eye swelling, proptosis, conjunctival congestion, vision loss	1	Contrast enhanced CT: Intraconal and retrobulbar hyperdense mass, Mucosal thickening of ethmoid sinus
Morghade S. et al 2021	Case report	1	1	Dull aching pain, facial swelling, ophthalmoplegia, vision blurring, proptosis and chemosis	1	MRI : Invasive fungal sinusitis, fluid collection and intracranial fungal extension
Gupta D. et al 2021	Case report	2	2	Throbbing and radiating pain, facial swelling, mobility of teeth, palatal gingival inflammation	2	 CBCT: Scattered hypodense areas of palatal and buccal wall of alveolar bone, discernible haziness and bone destruction, hazy soft

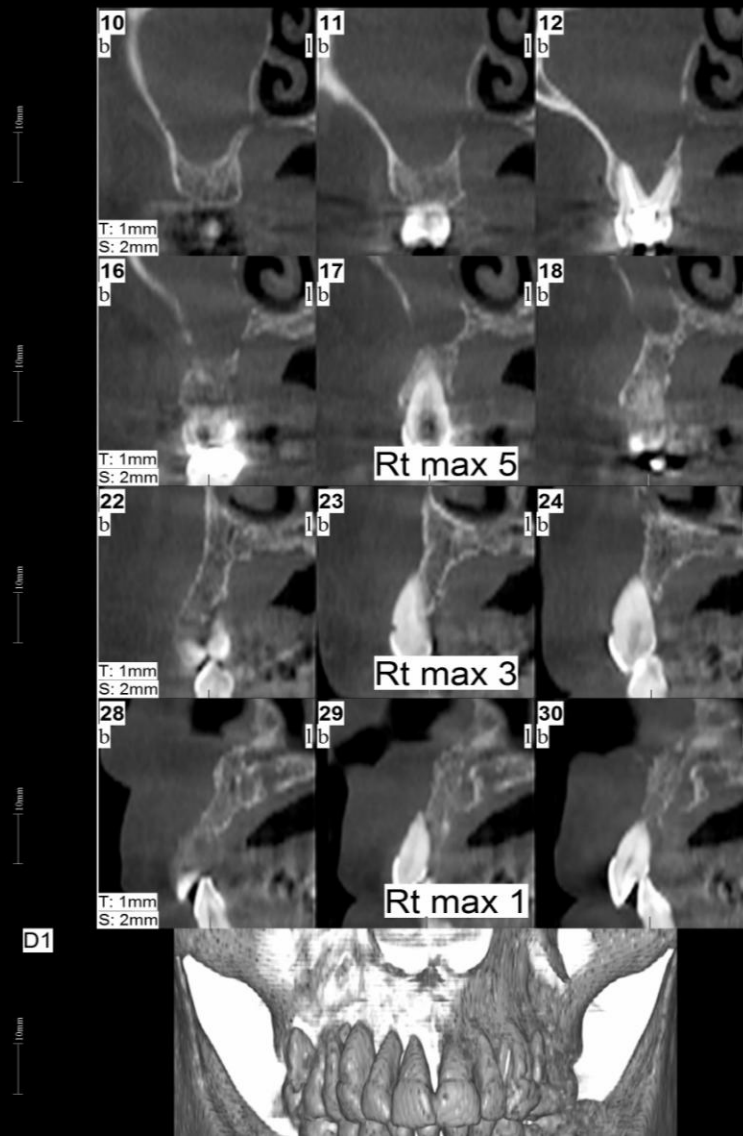
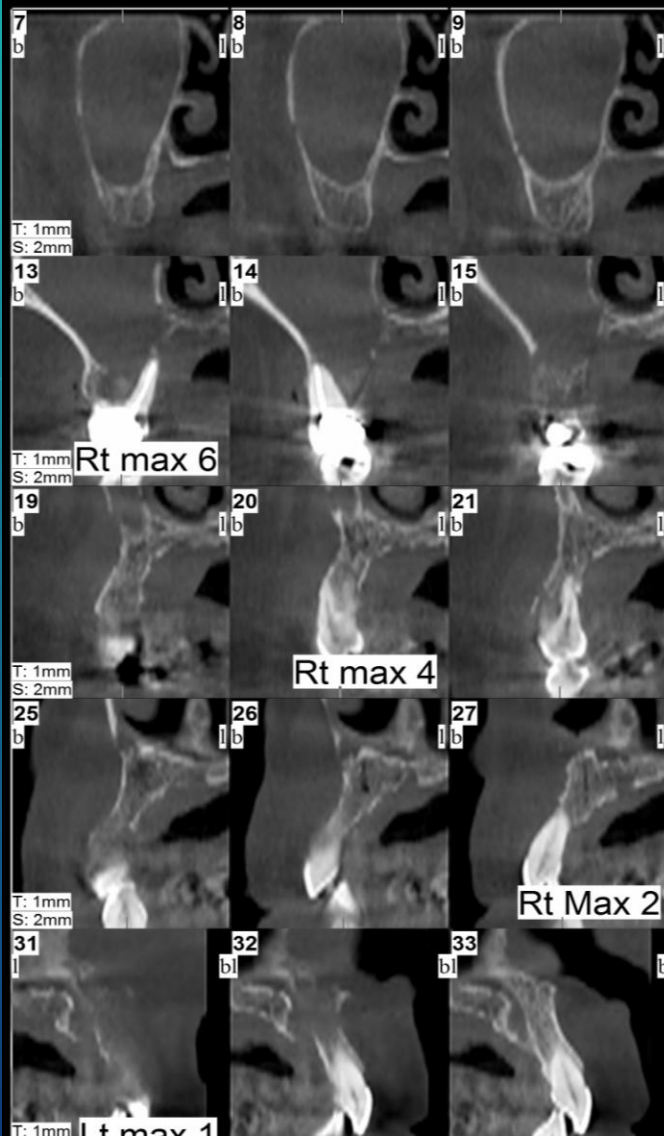
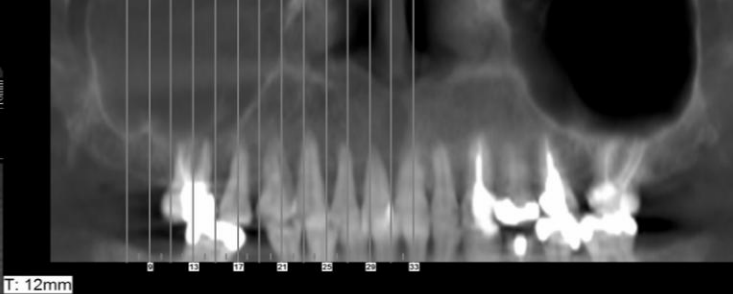
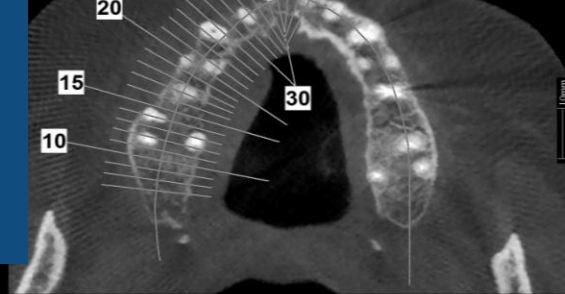
Pauli MA. et al 2021	Case report	1	1	Painful palatal lesion, radiating pain across the palate and middle third face	1	-
Shirke P. et al 2021	Case series	4	4	Peri-orbital swelling, pain, nasal regurgitation of fluids on intake, sinonasal discharge, teeth mobility	4	CT : Patchy bone destruction, hypertrophy of turbinate , septal deviation, maxillary and ethmoid sinusitis
Hadhimane A. et al 2021	Case report	2	2	Facial swelling, ptosis, alveolar bone exposure	6	CT: Erosive changes of alveolar bone, lateral wall of maxillary sinus and pterygoid body
Abha Kumari et al 2021	Case series	6	6	Nasal obstruction, facial pain and swelling, headache, proptosis, ptosis, ophthalmoplegia, palatal discoloration	6	CT; Fungal extension in all of the sinuses MRI: peripheral enhancement of orbital rim (indicating abscess)
Mishra Y. et al. 2021	Case series	32	32	Headache, redness and eye sore, palatal discharge, cutaneous symptoms	32	MRI: Fungal involvement of PNS and orbit
Nahara H. et al 2021	Case series	5	5	Headache, facial swelling, nasal discharge, ptosis, black crust on hard palate,	5	CT : mucosal thickening MRI : Retrobulbar fat stranding, , cavernous sinus thrombosis
Maini A. et al 2021	Case report	1	1	Eye sore and swelling, proptosis, chemosis, periorbital cellulitis, restricted medial gaze	1	MRI: ill-defined, heterogenous-intense, polypoidal mucosal thickening, breach of posterior portion of lamina papyracea
Rajasekaran S. et al 2021	Case series	5	5	Pain, periorbital swelling, paresthesia, blurred vision restricted mouth opening, necrotic black scar on palate, blackish discharge of palate	5	CT: Mucosal thickening, fluid collection in all sinuses
Ala Farid H. et al. 2021	Case report	1	1	Headache, cough, fever, malaise	1	MRA/MRV: Loss of flow-related signal at the left transverse sinus with suspension of thrombosis or stenosis

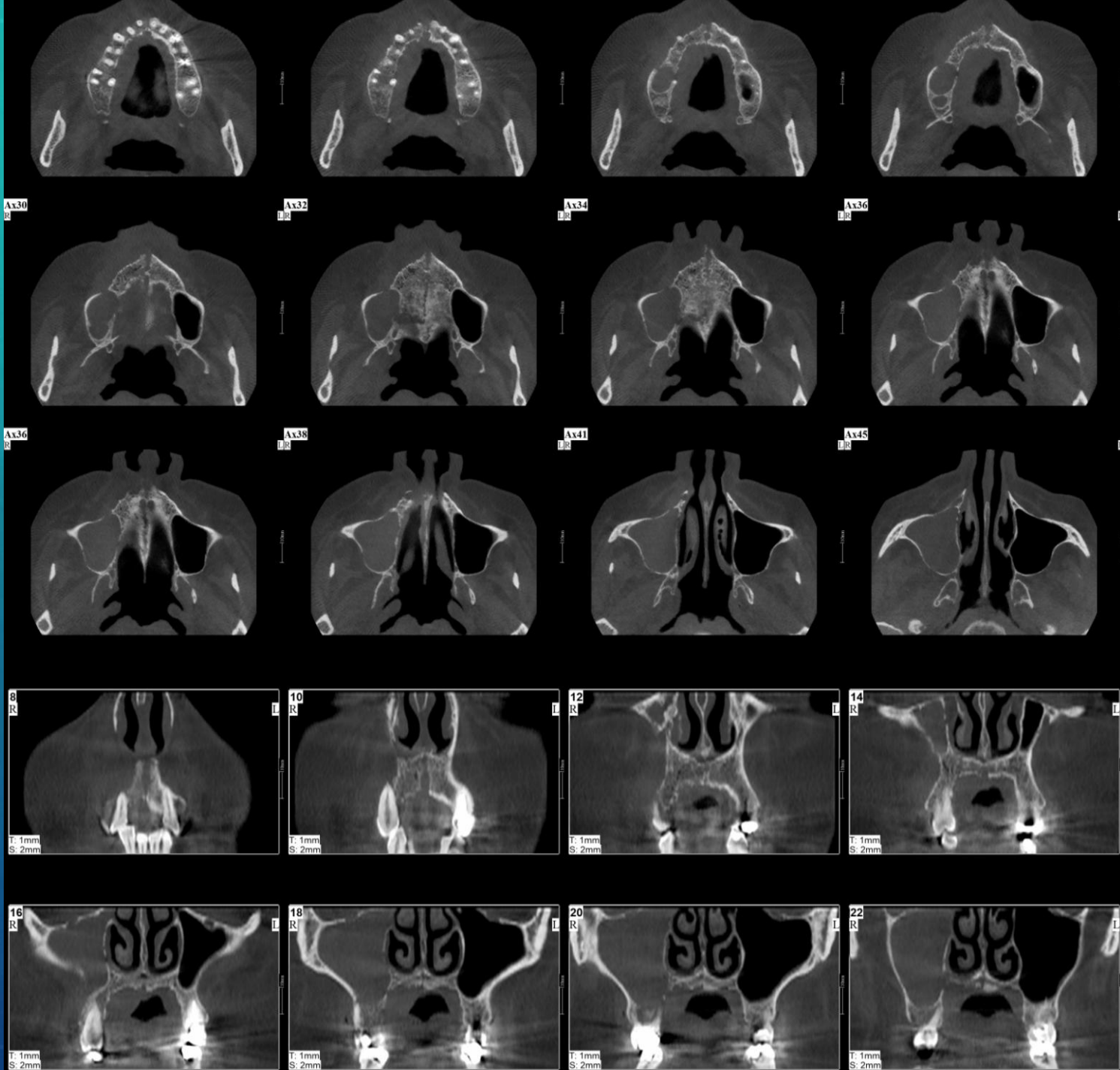
Pathak K. et al 2021	Case report	1	1	Ulcerative growth on hard palate with no pain, headache, vomiting, blackish-gray slough	1	-----
Avatef Fazeli M. et al 2021	Case series	12	12	Periorbital and retroorbital pain, facial cellulitis, headache, proptosis, loss of vision	12	CT :Mucosal thickening of paranasal sinuses, orbital fat stranding
Waizel-Haiat S. et al 2021	Case report	1	1	Midfacial pain, lid swelling, hypoesthesia, proptosis	1	Contrast enhanced CT : Mucosal thickening of all sinuses, soft tissue swelling without intracranial involvement, striation of extraconal fat
Roopa R. et al 2021	Case report	1	1	Sharp radiating pain, headache, fever	1	CT and Panoramic views : Mucosal thickening and opacification in nasal cavity and paranasal sinuses, ill-defined bony erosion of walls of maxillary sinus
Barman Roy D. et al 2021	Case series	5	5	Severe pain, headache, blurred vision, nasal congestion	5	MRI : Mucosal thickening
Fouad Y. et al 2021	Case series	12	12	Facial swelling, diminished vision proptosis, proptosis, chemosis	12	MRI : Air loculi secondary to osteosclerosis, perineural spread of fungus across trigeminal nerve, cavernous sinus involvement
Selarka L. et al 2021	Case report	1	1	Headache, toothache, ulcerative eschar on palate, blocked nose with blackish discharge	1	MRI : Altered signal in maxillary sinus, agar nasi, and turbinate
Rameswami A. et al 2021	Case series	70	70	Swelling and pain in eyes, diminished vision, proptosis and ptosis	70	Contrast enhanced CT : Mucosal thickening
Sen M. et al 2021		2826	2826	Pain, edema, nasal stiffness, ptosis, diplopia,	-	MRI : mucosal thickening , severe fungal involvement of PNS
Alekseyev K. et al 2021	Case report	1	1	Deep aching pain, tooth loss, cough	1	CT : Fungal involvement of PNS MRI : intracranial abscess, cavernous sinus enhancement



53 Y
Covid+
She took high dose of Steroid
She gave Hx of diabetic crisis
during getting infection

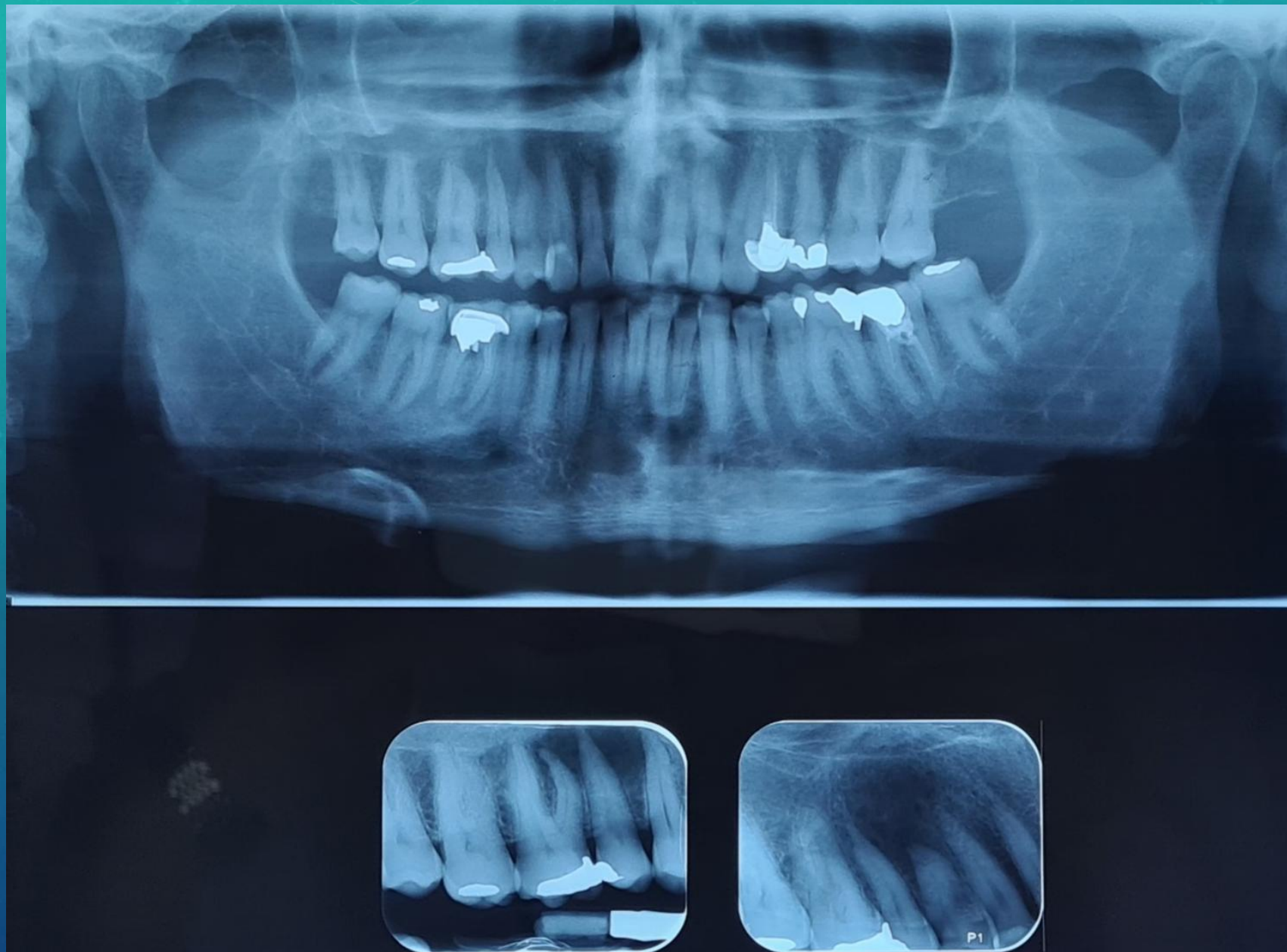


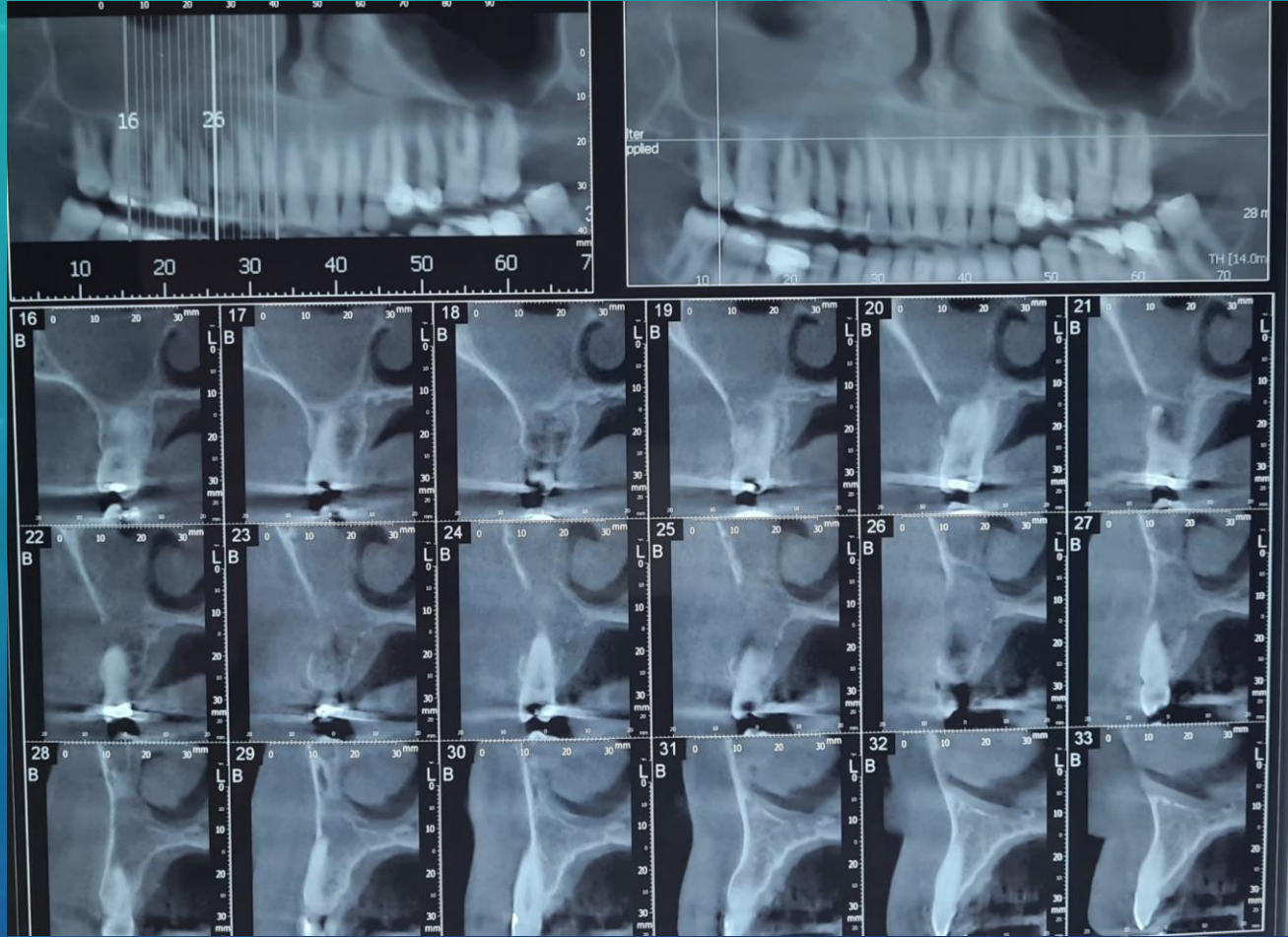
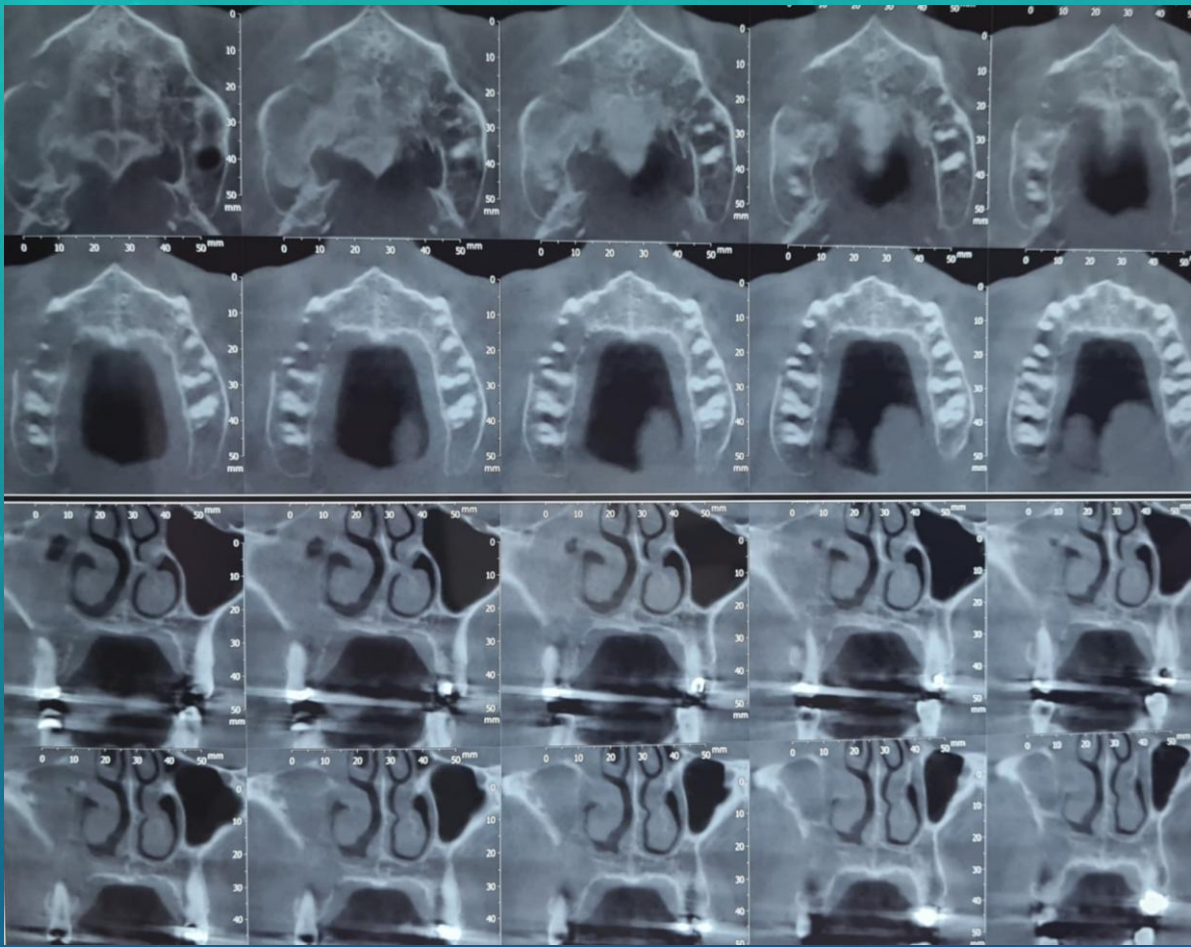






47 Y/O
No DM
Caught Covid +
Gave High dose of steroids and
Remdesivir



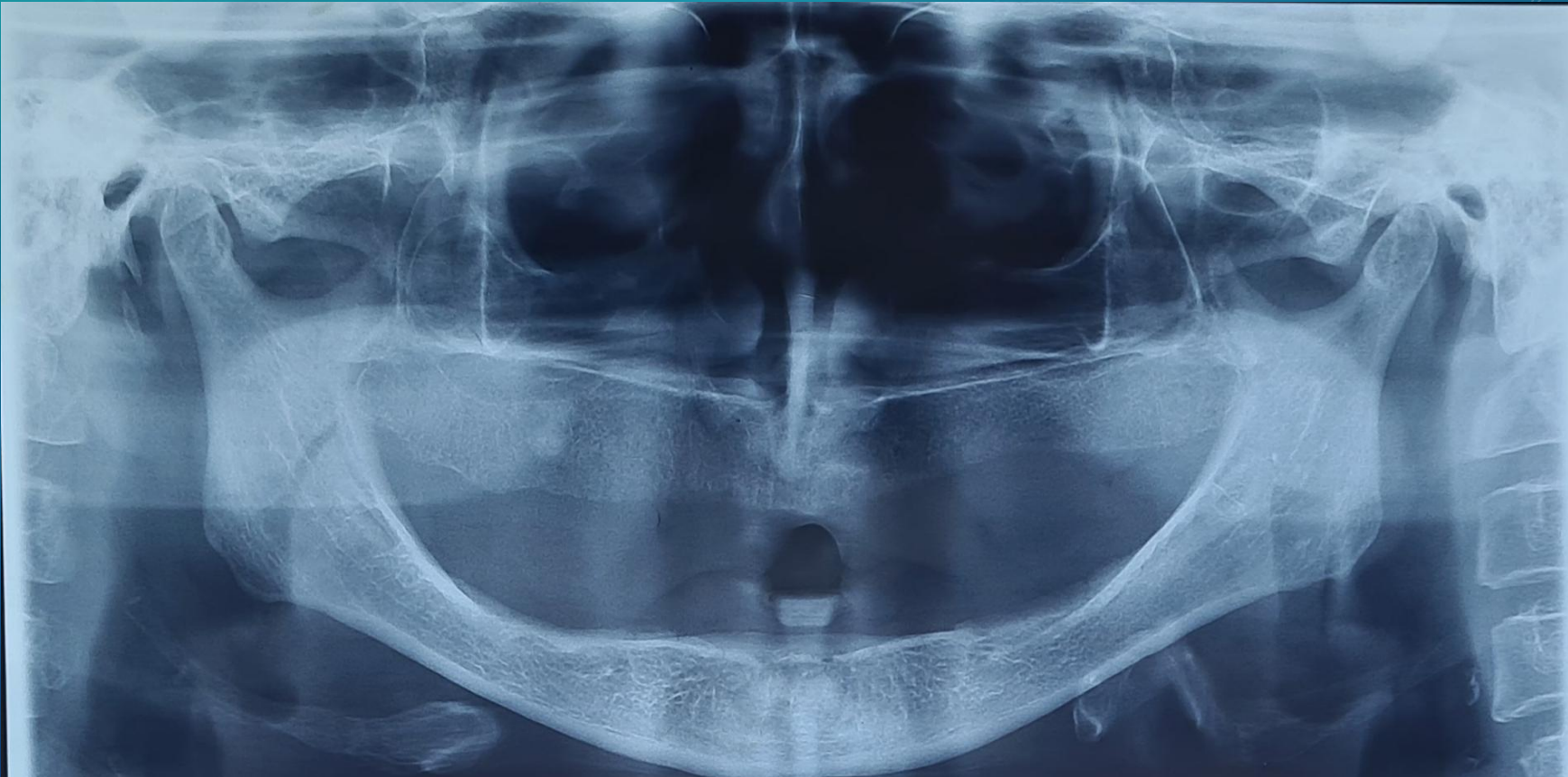


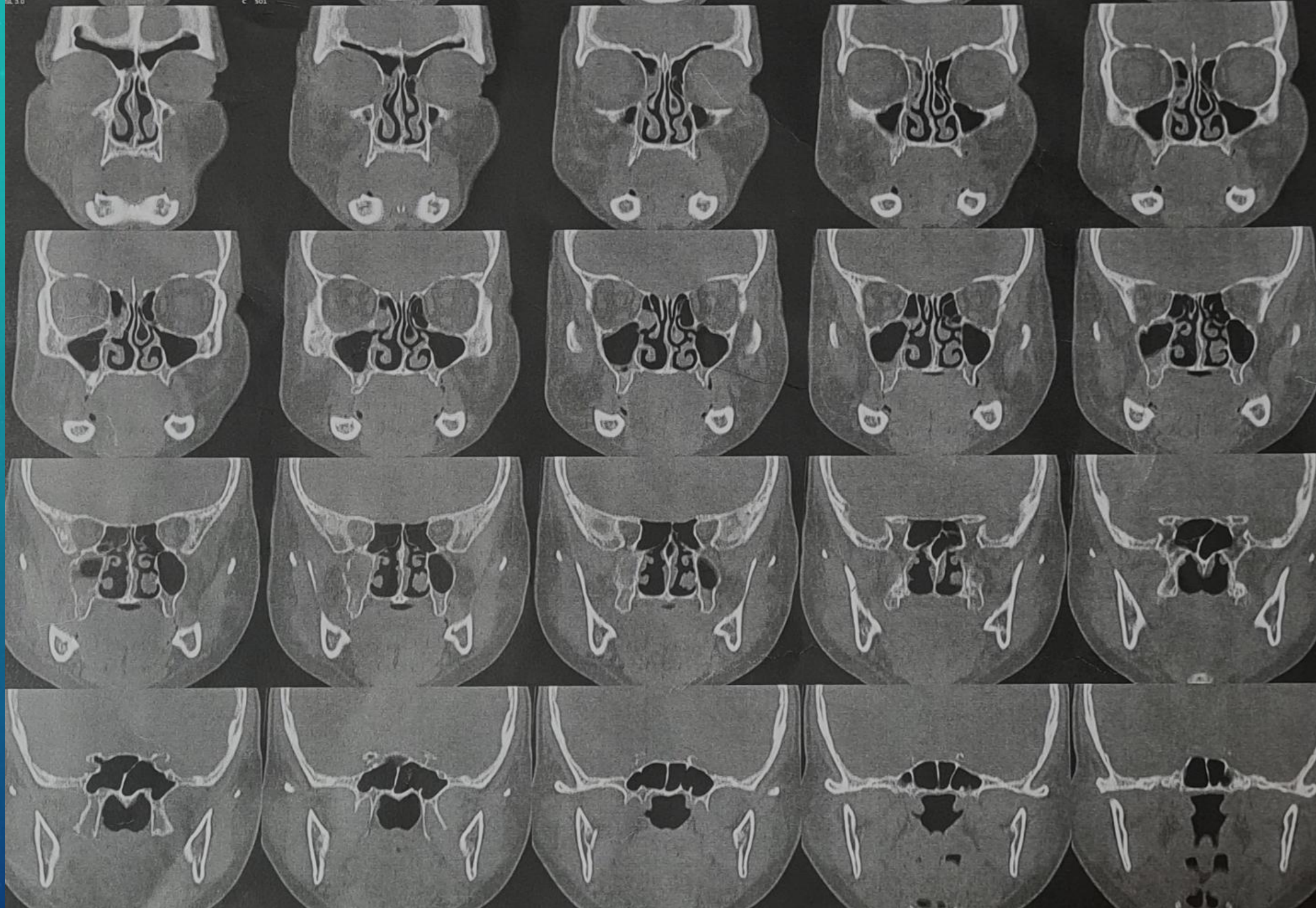
Case 3



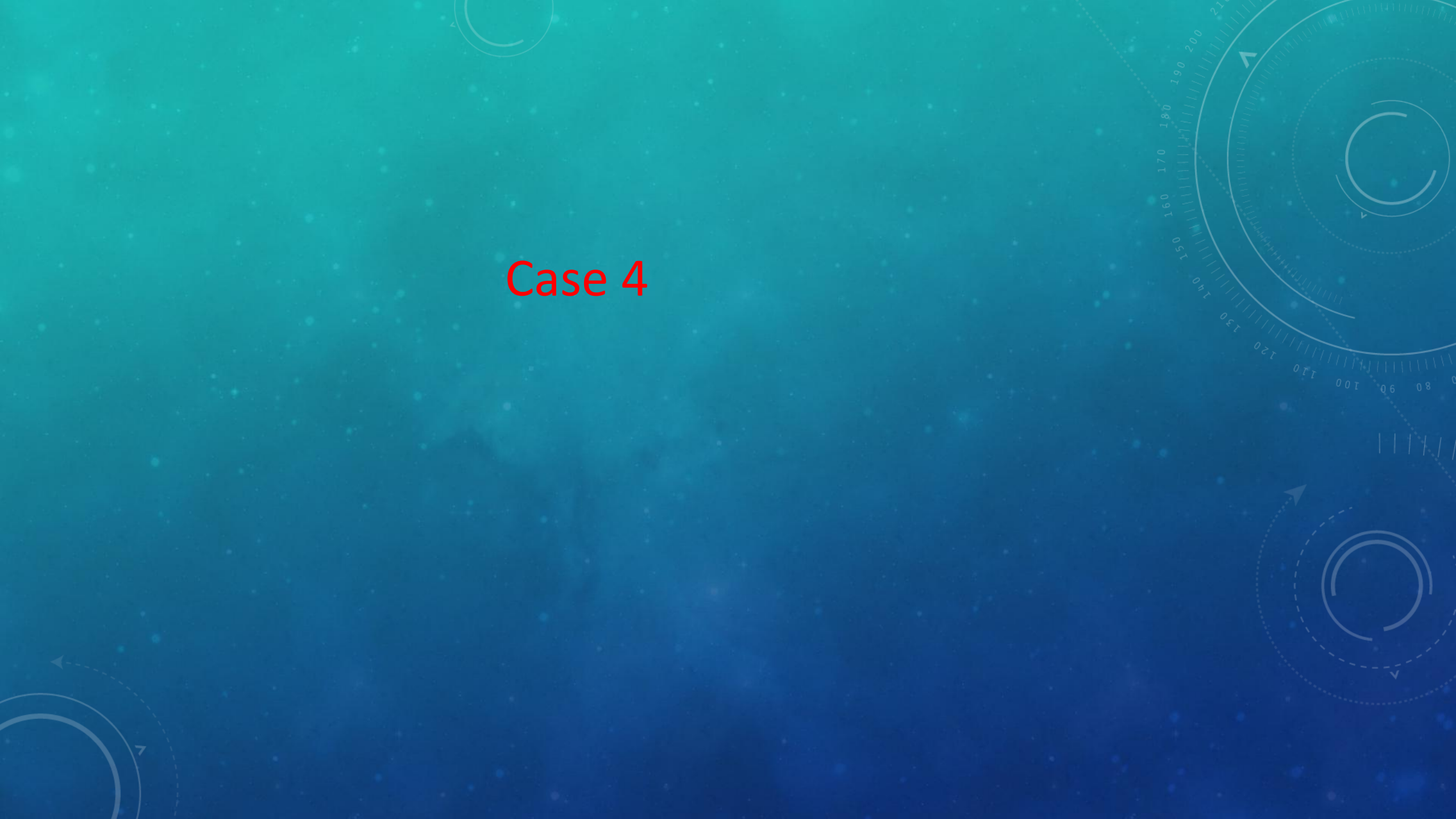


58 Y/o
COVID 19 +
Tenderness on Rt side of the maxilla
Paresthesia of Rt posterior maxillary
region





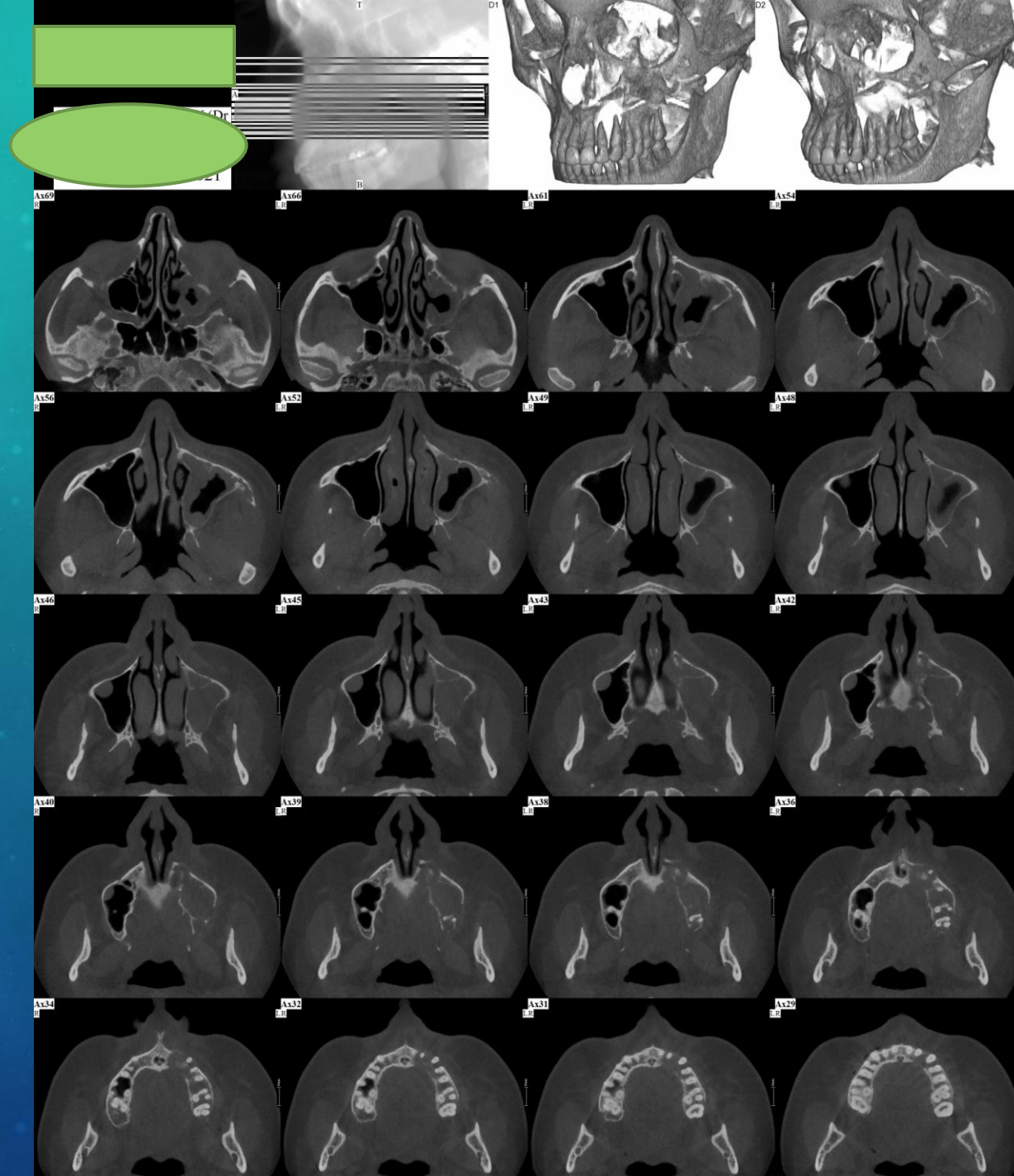
Case 4

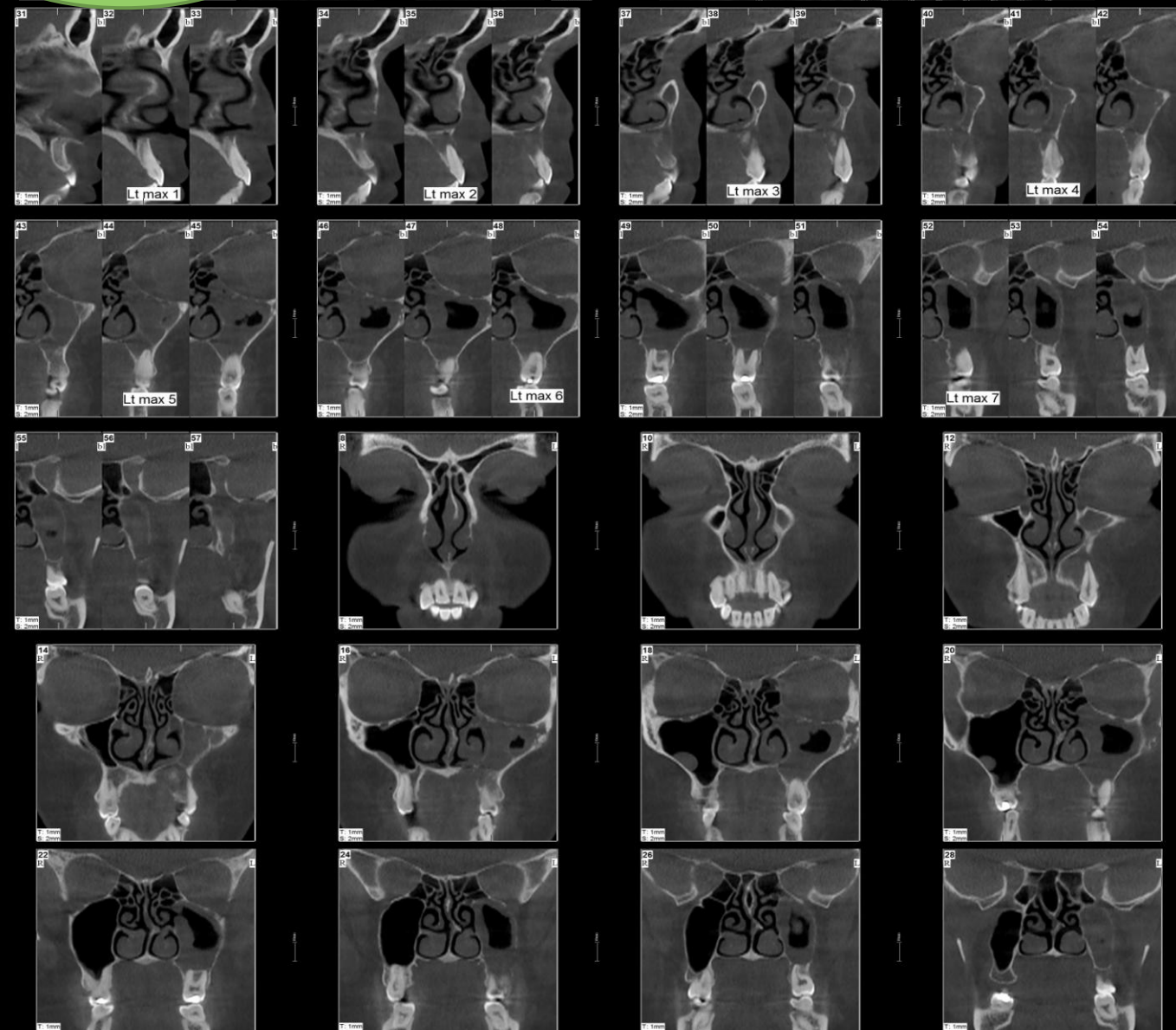
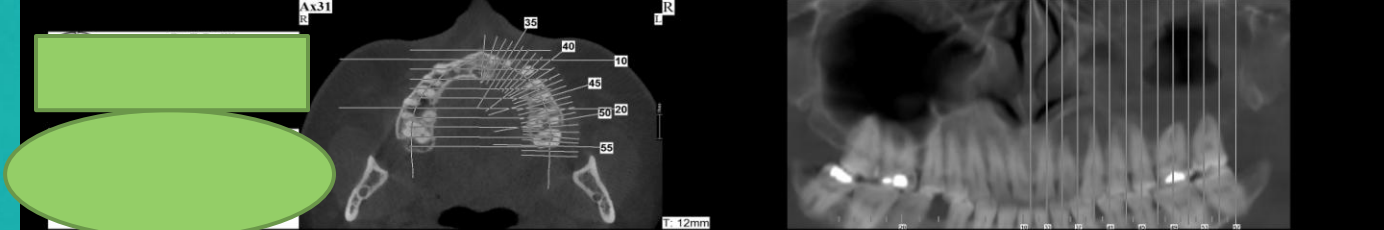




34Y female
+ covid
High dose steroid





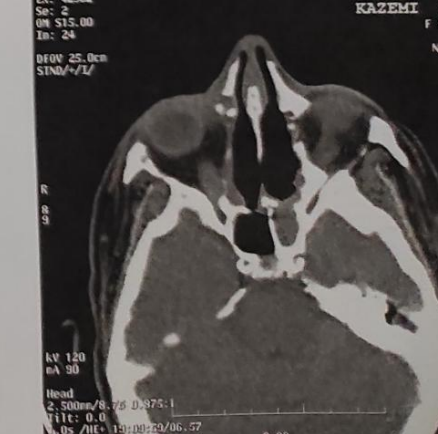
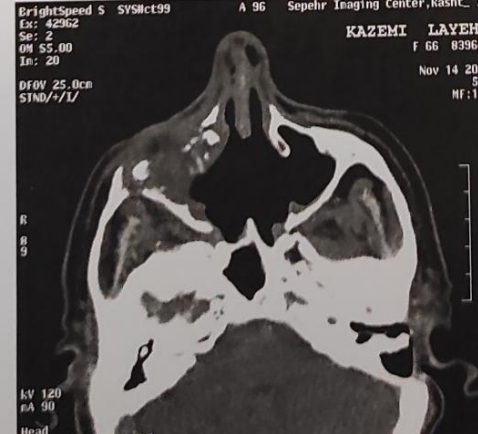
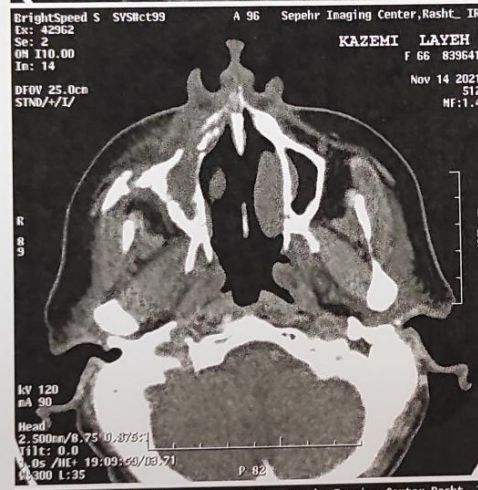
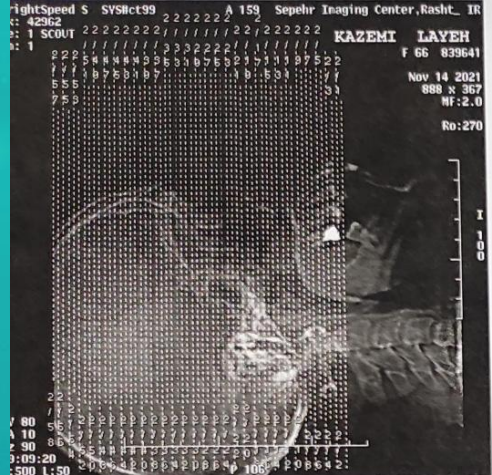


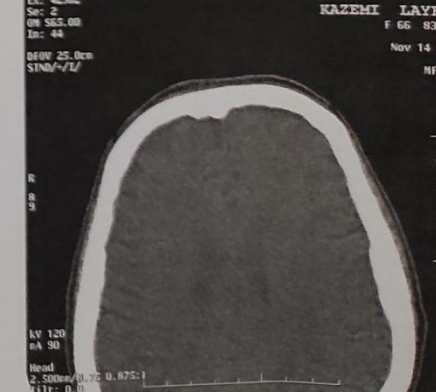
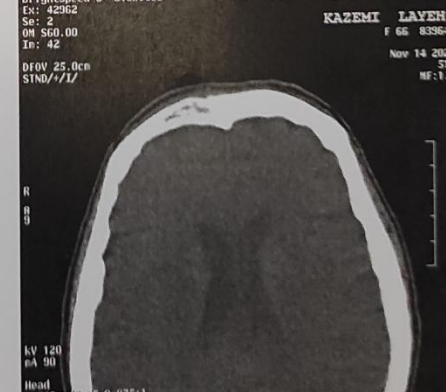
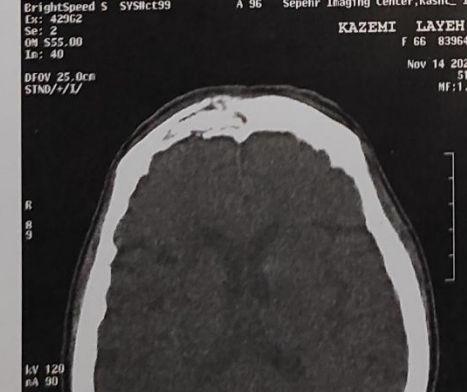
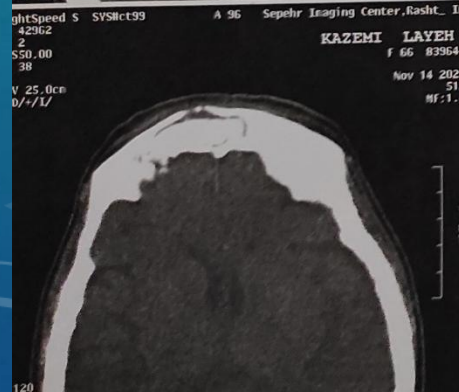
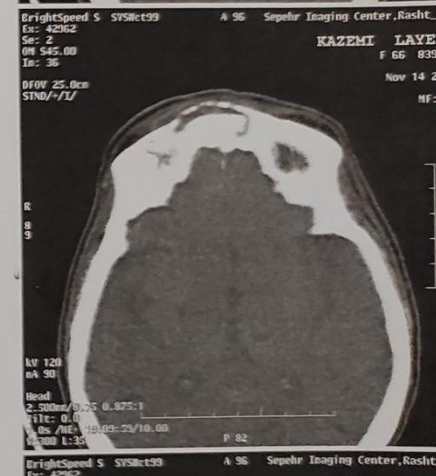
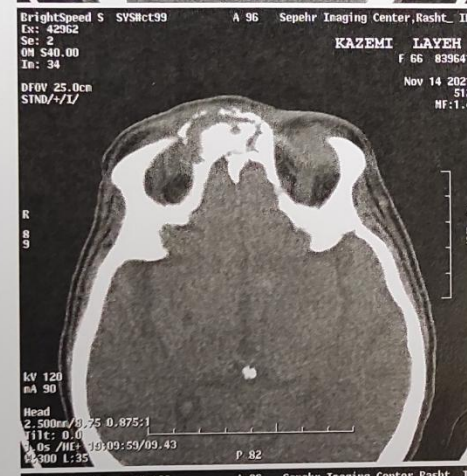
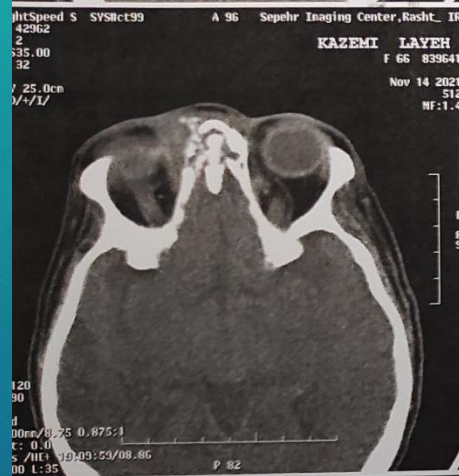


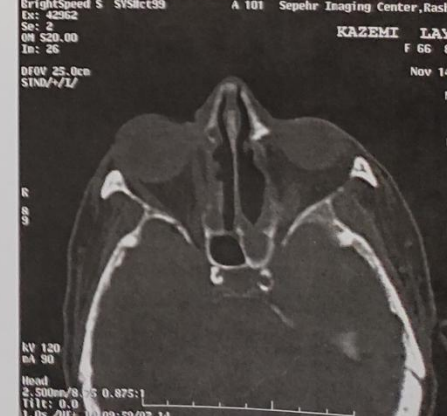
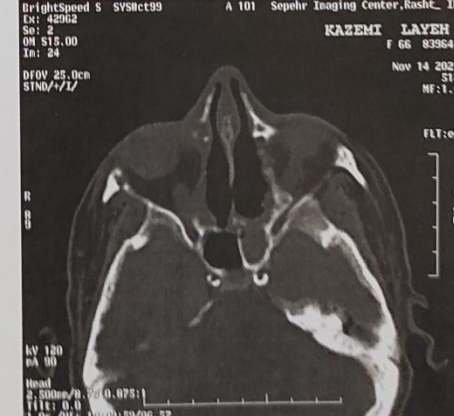
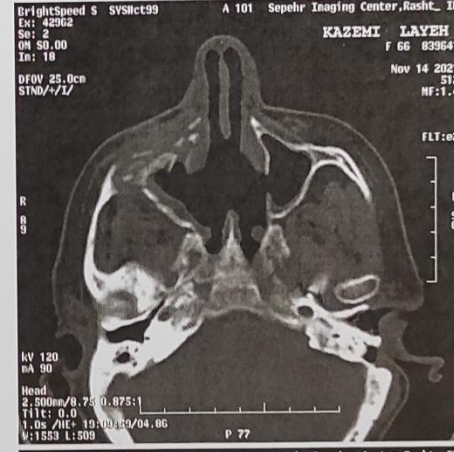
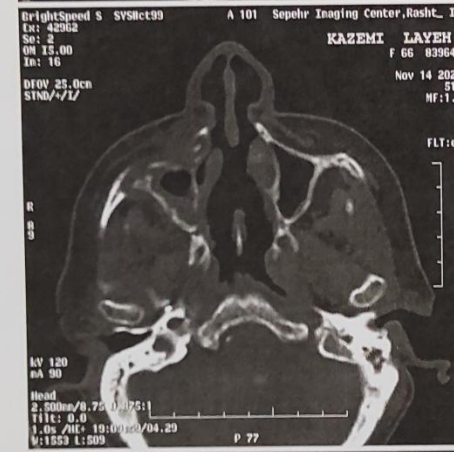
66Y/O

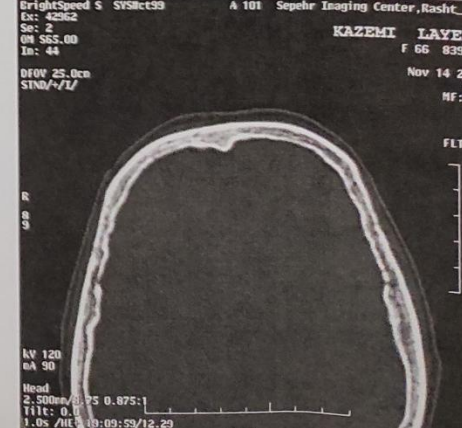
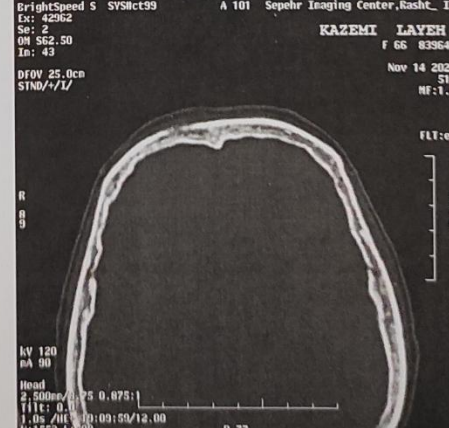
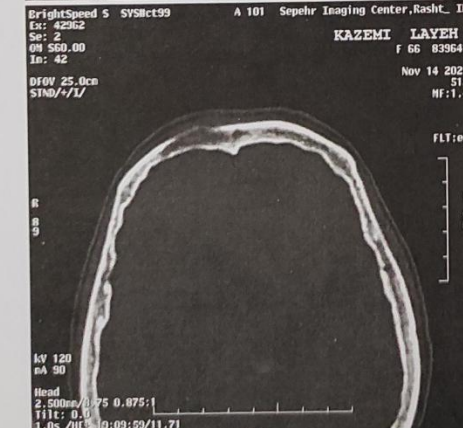
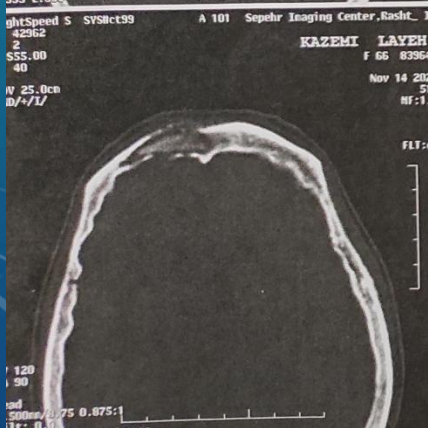
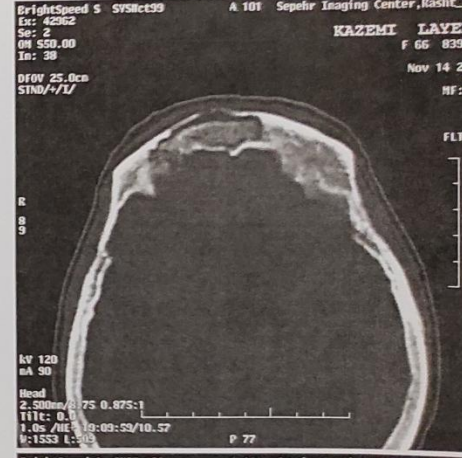
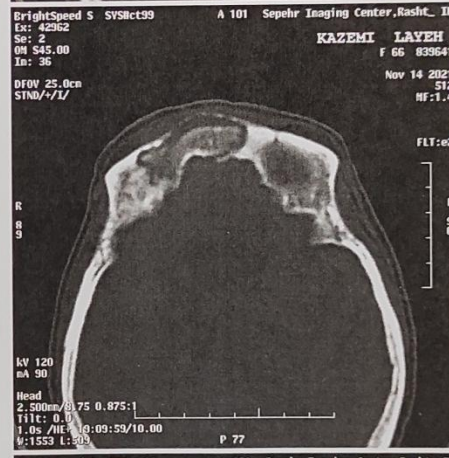
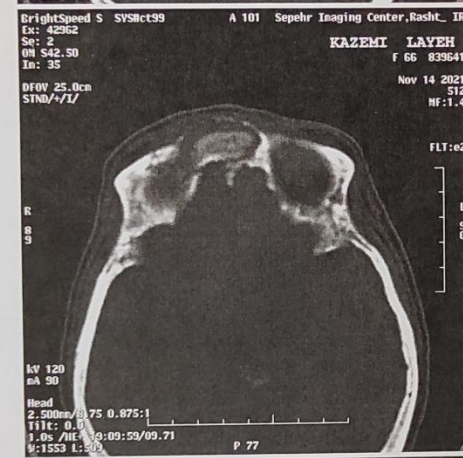
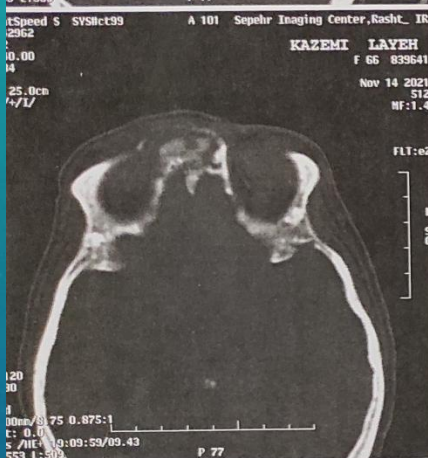
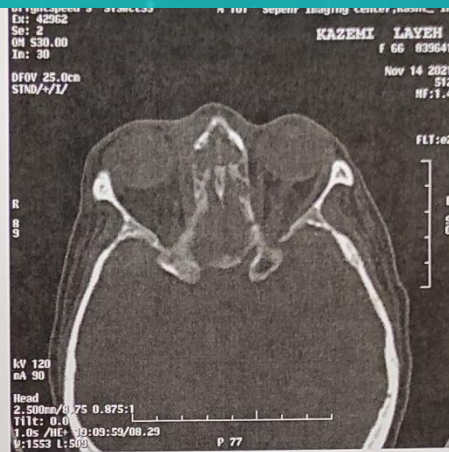
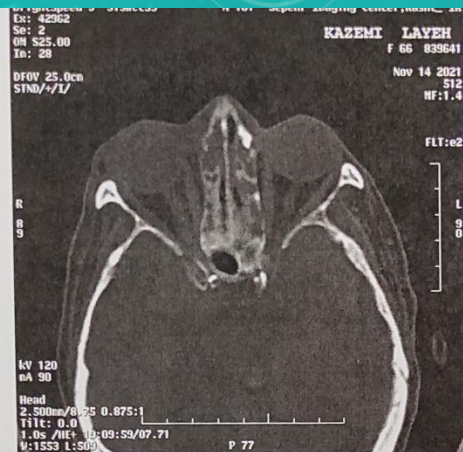
- DM
- Covid +

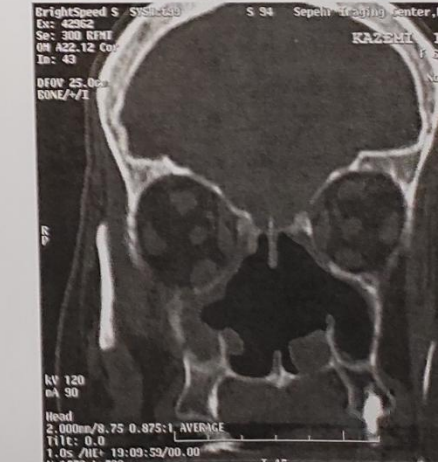
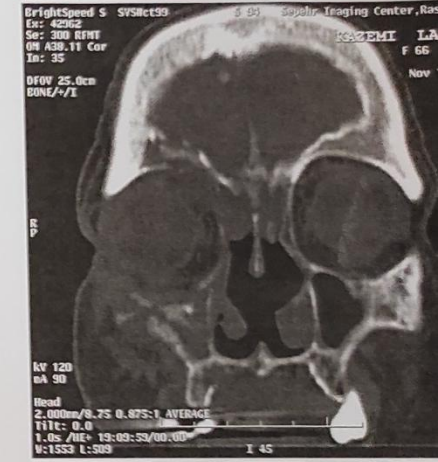
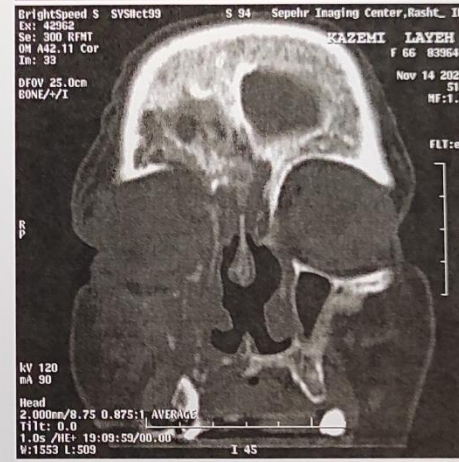
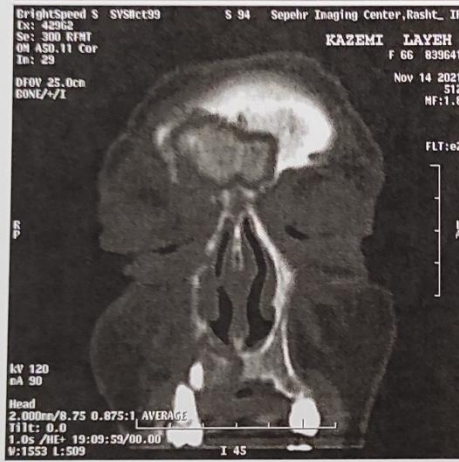
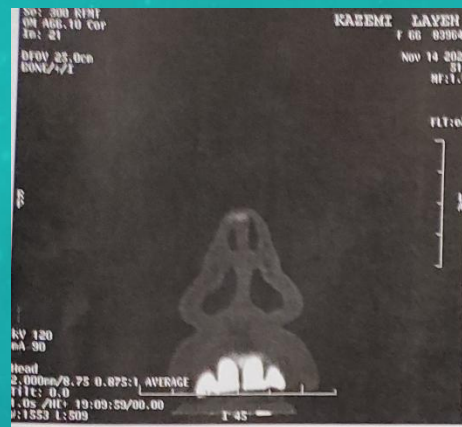


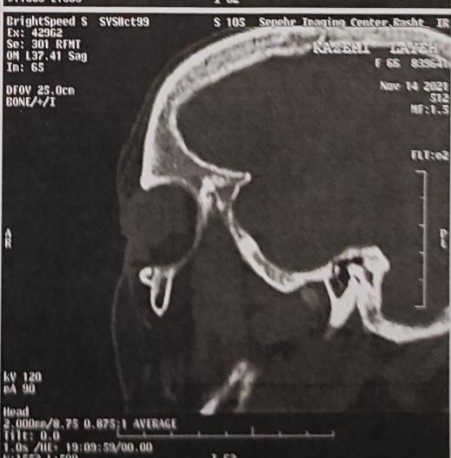
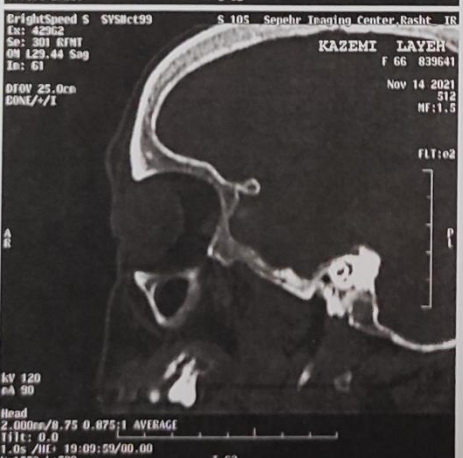
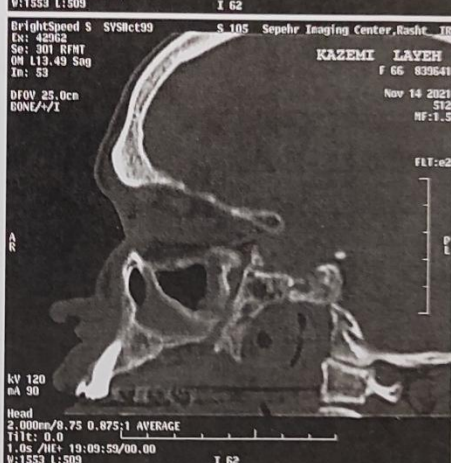
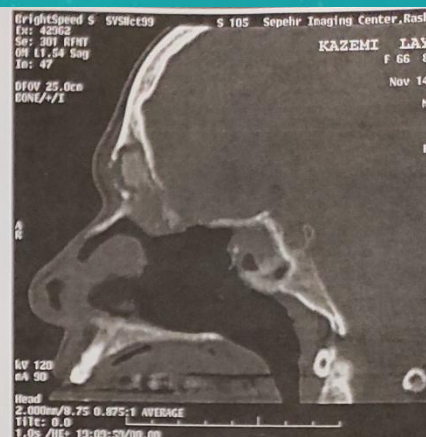
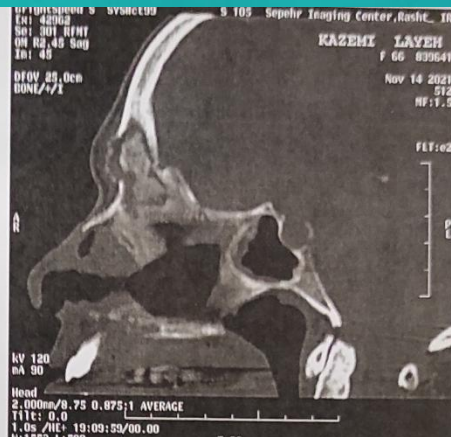
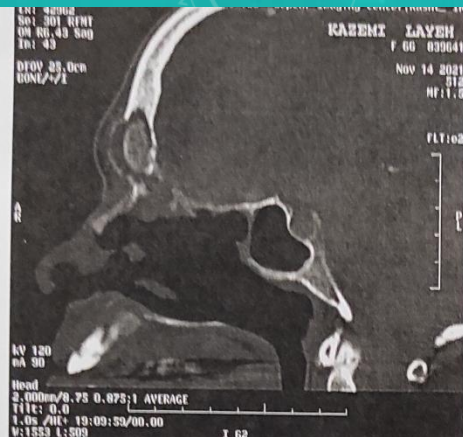
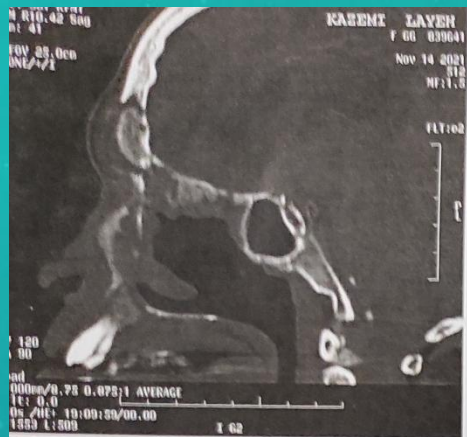










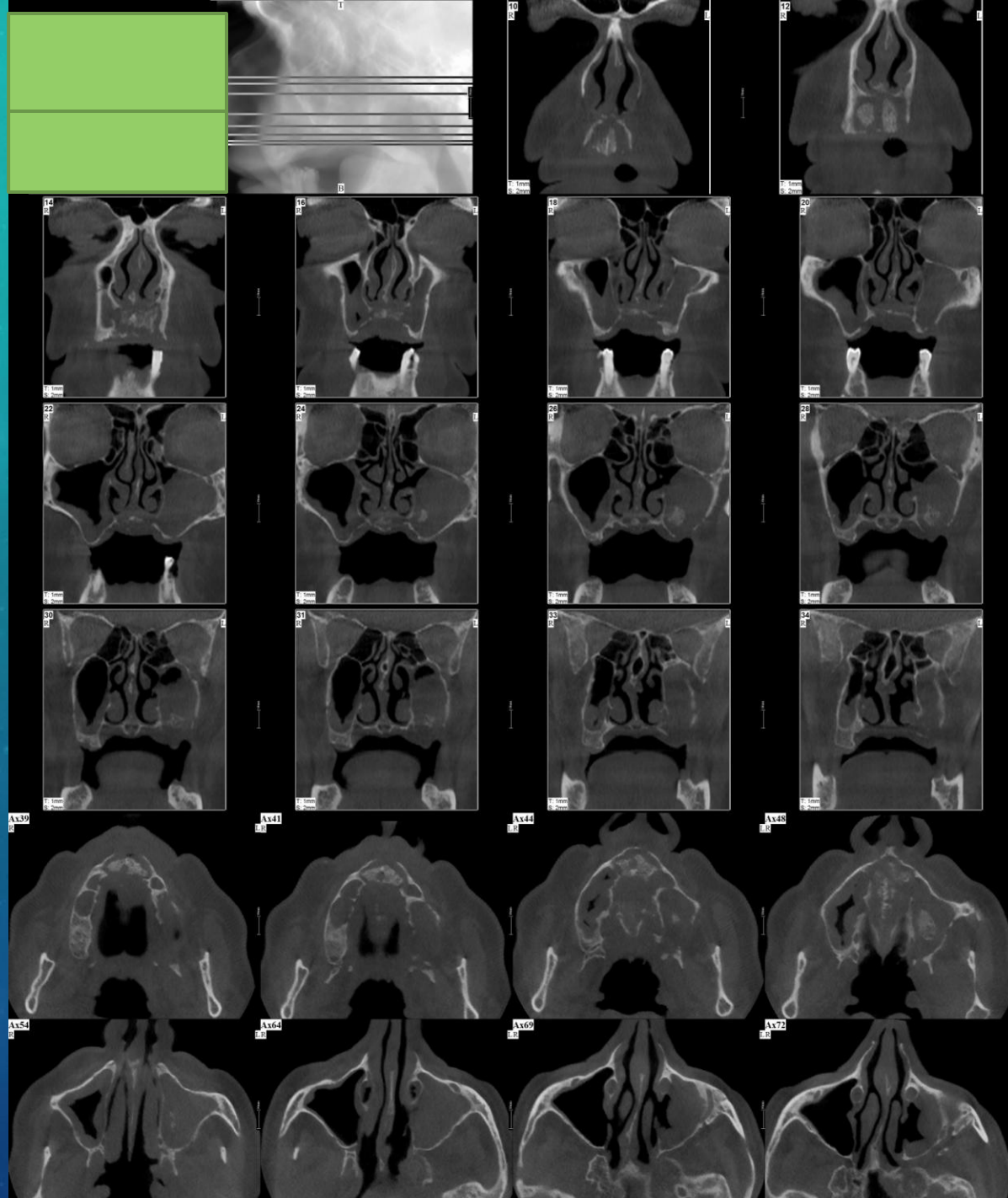


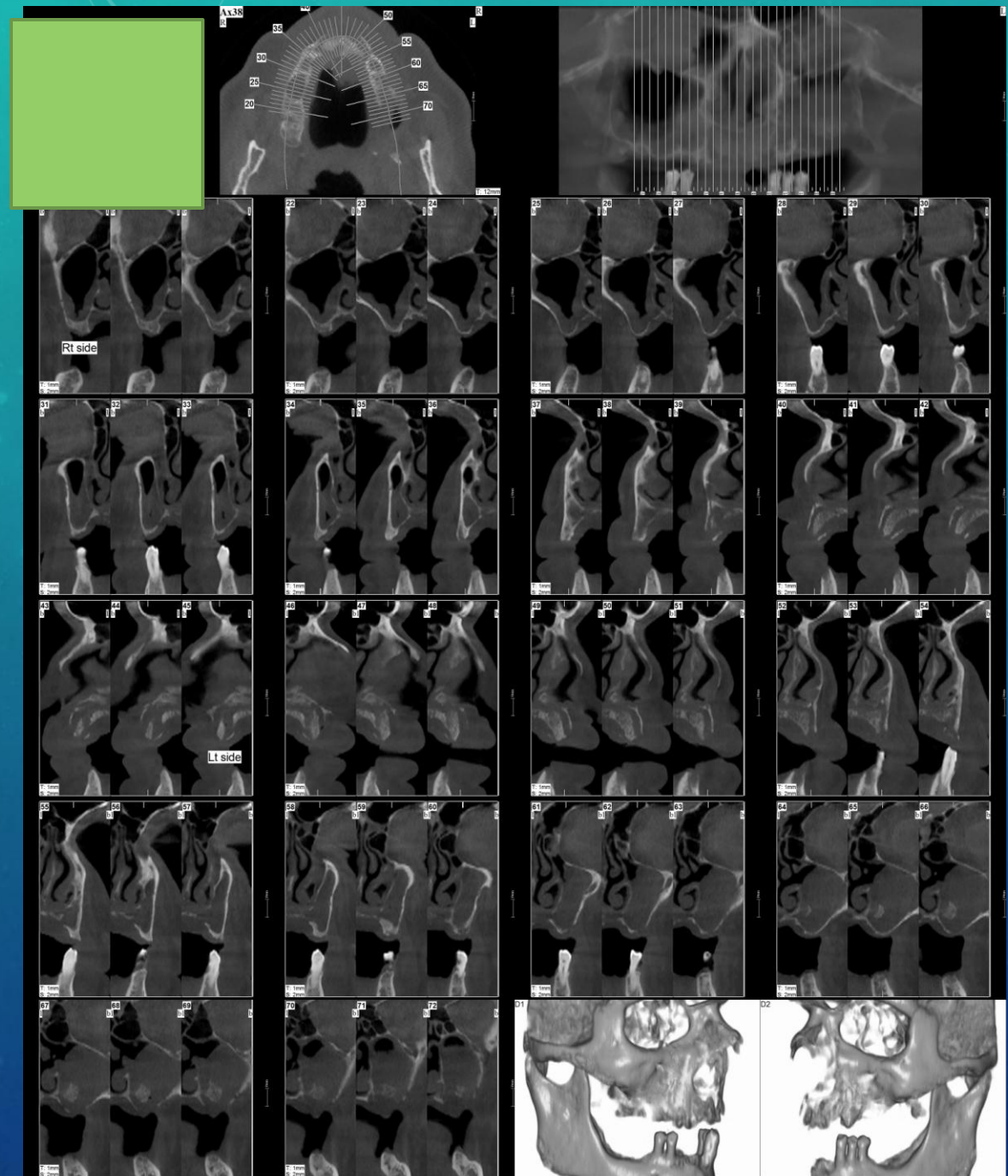
Case 6



CRANEX D









Thank you for your attention

