Facial, lingual, and infraorbital artery calcification: A rare incidental radiographic finding

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SUMMARY

Identifying calcification of arteries in the head and neck region may aid in the diagnosis of advanced systemic conditions. In contrast, failure to recognize them can result in incorrect diagnoses and ineffective treatments. Radiographic analyses can be used to detect such calcifications. This report focuses on calcifications discovered in the facial, lingual, and infraorbital arteries following a routine dental care panoramic radiograph. This report is particularly notable because it is the second in the literature to highlight the calcification of all three arteries.

Key words: Arteriosclerosis – Medial calcinosis – Panoramic radiograph

INTRODUCTION

A comprehensive understanding of anatomy and its variations is the basis for a precise diagnosis and treatment strategy; failing in this respect may lead to misdiagnosis and undesirable treatment. Clinicians appreciate the external anatomy upon clinical examination; however, the internal anatomy necessitates further investigation, specifically radiography.

Routine radiographic evaluations show clues to some systemic conditions. Appreciation of sporadic incidental findings in the radiographic image is crucial to the patient's health care. Nevertheless, a thorough history and clinical examination in conjunction with radiographic imaging often aid in recognizing the underlying specific systemic diseases. Panoramic radiographs for primary screening are an excellent tool for detecting structural changes and soft tissue calcification due to their accessibility, affordability, and reliability.

This report represents a rare instance of a male patient exhibiting soft tissue calcification in branches of the external carotid artery detected by panoramic radiography. There are scanty reports in the scientific literature concerning calcification of the facial artery, lingual artery, maxillary artery, etc., in the head and neck region. To date, only two cases of calcification involving the infraorbital artery have been reported. This article reports a rare third instance of the calcification of the infraorbital artery and a second case in the scientific literature reporting the calcification of three arteries: the facial, the lingual, and the infraorbital artery.

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Submitted: December 12, 2022. **Accepted:** January 18, 2023

https://doi.org/10.52083/IYAU7211

CASE REPORT

A 67-year-old male patient presented with the chief complaint of swelling in the right lower third of his face that had been present for one week and was gradually increasing. This was preceded by a toothache in the right lower back tooth region two weeks prior. The patient presented with a medical history of Type II diabetes mellitus and hypertension for the past 15 years, along with chronic renal disease, for which he had been undergoing haemodialysis twice a week for the past 5 years. He was on medication for diabetes (glipizide and metformin), hypertension (telmisartan), and renal disease (furosemide and allopurinol). In addition, the patient was also on pantoprazole 40 mg (once daily) for oesophageal reflux and calcium supplements (calcitriol and cholecalciferol). The patient's blood work showed elevated levels for the following parameters: serum creatinine level was 7.2 mg/dL (normal range: 0.5 to 1.1 mg/dL); gamma-glutamyl transpeptidase level was 140 U/L (normal range: 3-35 U/L); lipase level was 440 U/L (normal range: 0 to 60 U/L); ferritin level was 589 ng/mL (normal range: 12 to 200 ng/mL); total triglycerides: 254 mg/dL (normal range: 25 to 200 mg/dL); Random blood sugar: 240 mg/dL.

On examination, the facial asymmetry was very noticeable on the right side. There was a large, diffuse swelling on the right side of the face that was about 3.4 cm long and went from 1.5 cm below the right infraorbital margin to the lower edge of the mandible. Anteroposterior, from the right commissure of the lip, till 0.5 cm away from the angle of the mandible. The skin over the swelling was smooth and glossy, and there was no pus discharge or sinus opening.

Intraoral examination revealed deep dental caries involving the left maxillary central and lateral incisors, left mandibular second premolar and third molar, and right mandibular first and third molar, along with a grossly decayed right mandibular second molar with tenderness noted in the buccal vestibule. Generalized gingival recession and gingival inflammation were also observed. The upper and lower arches were partially edentulous. Deep dental caries in the right first, second, and third molars was diagnosed, leading to submandibular and submental space infections. A preliminary panoramic radiograph was advised, which depicted deep dental caries in the right mandibular first molar and a homogenous periapical radiolucency with a well-defined sclerotic border. The right mandibular second and third molars were grossly decayed, with features of chronic periapical abscesses. Generalized horizontal and vertical alveolar bone loss was observed with the normal trabecular pattern in both the maxilla and mandible.

This case presented an incidental finding near the angle, and the body of the mandible bilaterally had a radiopaque "tram track" or "pipeline" or "rail track" arrangement that emerged beneath the angle and the body of the mandible, followed a tortuous course, wrapping over to the hyoid bone. This calcification turned an S-bend (two loops), first winding down over the submandibular gland fossa and then up over the base of the mandible (Fig. 1). Bilaterally towards the ramus of the mandible, a tortuous upward loop of calcification was evident. The calcification extended laterally towards the left ramus of the mandible and the coronoid notch, at the levels of C1, C2, and C3. Unique to this case was the calcification running towards the left infraorbital rim and crossing the pterygomaxillary fissure. This uniform line mimics soft tissue calcification.

DISCUSSION

Arteries are vital components of the circulatory system, primarily transporting oxygenated blood from the heart to various parts of the body. They are made up of three layers: the tunica intima, media, and adventitia, which are comprised of smooth muscles that allow constriction and dilation via parasympathetic nervous system signals. Over the years, the arteries undergo age- or health-related issues that may lead to the thickening of arterial walls. Dystrophic calcifications in the arteries of the head and neck region, which manifest as atherosclerosis or arteriosclerosis, are extremely rare. Atherosclerosis is the constriction of arteries caused by a persistent inflammatory condition that leads to the accumulation of cholesterol, fatty substances, cellular waste products, calcium, and fibrin, which form a plaque within the large and medium-sized arteries (Castling et al., 2015).

Arteriosclerosis, on the other hand, usually affects the small arteries (Diehm et al., 2013). It is believed that "intimal fibromuscular tissue" or "hyaline" deposits in small arteries, with one or two layers of smooth muscle cells, lead to the thickening of the arterial wall (Fishbein and Fishbein, 2015). In 1903, arterial calcification was first described by Monckeberg as the calcification of tunica media, an intermediate layer of the artery wall composed of smooth muscle and elastic fibers, which was then referred to as "Monckeberg sclerosis or medial calcinosis" (Tahmasbi-Arashlow et al., 2016; Castling et al., 2015). Monckeberg medial calcinosis, unlike atherosclerosis, does not impede the arterial lumen; rather, there is a loss of vascular elasticity and compliance due to substantial perfusion reduction and clinically significant coronary and peripheral artery disease.

The extracellular matrix, as well as cells of the media or intima of the vascular endothelium, are thought to be the cause of vascular calcification. These are the sites where hydroxyapatite with a significant level of crystallization tends to deposit, eventually leading to vascular calcification (Tahmasbi-Arashlow et al., 2016). Atherosclerotic lesions are greatly influenced by genes involved in lipoprotein metabolism. For instance, deficiency of apolipoprotein E (ApoE), a protein necessary for the liver's clearance of chylomicron and very-low-density lipoprotein (VLDL) remnants, can lead to the formation of atherosclerotic lesions (Schinke et al., 1998).

Calcification of the "cheek arteries" was the first instance of calcification in the arteries of facial tissues, as described by Ennis and Burket (1942). These calcifications are usually an indication of the severity and progression of conditions such as diabetes, hyperparathyroidism, coronary artery disease, chronic renal disease, and arteriosclerosis. Furthermore, this condition has been linked to hypervitaminosis D, hyperlipidaemia, aging, chronic inflammation, and autoimmune diseases such as systemic lupus erythematosus (Prasad et al., 2015).

One such condition of arteriosclerosis is medial calcinosis, which is associated with end-stage renal impairment. Even though the cause of medial calcinosis is unknown, vascular smooth muscle cells in the tunica media have been identified as the major cells involved in its formation. In longitudinal studies, the prevalence of medial calcinosis was found to be 6.9% in females and 13.3% in males (Byon and Chen, 2015). Vascular calcification was found in nearly 40% of chronic renal disease patients compared to 13% of controls, as per the study by Russo et al. (2004). The Centers for

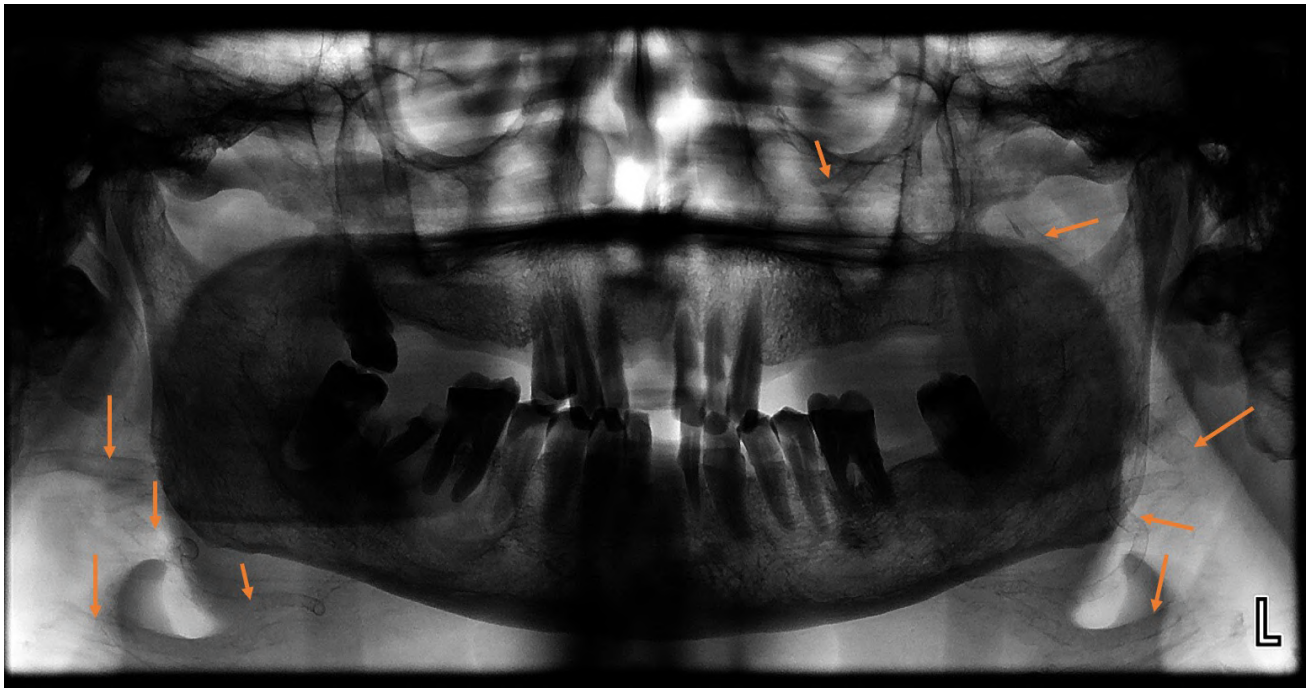

Fig. 1.- Panoramic radiograph shows an inverted-tone image depicting *tram line, pipestem, or tram track* calcification.

Disease Control and Prevention observed in 2021 that 36.8% of diabetic patients aged 20 years and older had chronic renal disease. In 2018, Frazier et al. published the first case report of infraorbital artery calcification in a patient with chronic renal disease and diabetes mellitus. According to Kramer et al. (2005), patients with chronic renal disease and diabetes are significantly more likely to present with medial calcinosis, which is consistent with the current report. Such calcifications are rarely visible on radiographs. When Miles and Craig (1983) examined 2422 panoramic radiographs taken between January 1980 and August 1981 at a Veterans Administration Centre, they discovered six cases of facial artery calcification. Furthermore, Brooks et al. (2022) reported a second incidence of facial and infraorbital artery calcification in a panoramic radiograph. On a radiograph, medial calcinosis appears as paired linear areas of calcification in soft tissue, which have been referred to as "pipeline," "tunnel track," "pipe stem," "railroad track," and "tram line"-like appearances when viewed longitudinally, as well as a circular calcification in a cross-sectional view (Castling et al., 2015).

When vascular smooth muscle cells were cultured with high phosphate concentrations in an in vitro study (Speer et al., 2009), vascular calcifications were observed, indicating that these types of calcifications can be observed in patients with hyperphosphatemia. This was a similar presentation in a 64-year-old male with type II diabetes mellitus, chronic renal disease, hyperphosphatemia, hypercalcemia-related illness, secondary hyperparathyroidism, and kidney failure, in addition to calcification of the lingual artery, facial artery, internal maxillary artery, transverse facial artery, and superficial temporal artery (Macdonald et al., 2012). In this report, similar results were found. The patient had type II diabetes, high blood pressure, chronic kidney failure, and high phosphate levels. There were also calcifications in the infraorbital, facial, and lingual arteries (Fig. 2).

To the best of our knowledge, after a thorough search, this is the third well-documented instance of reporting infraorbital artery calcification in scientific literature. Anatomical features, morphological changes, and extensions may all be seen by 3-D scans, which also reveal the structure's form, origin, location, and relations to associated structures and help in further investigations.

This report emphasizes the significance of identifying the incidental finding of medial calcinosis and its clinical implications in terms of the patient's general health, as nine out of ten individuals with chronic kidney disease are unaware of their ailment. This was easily accomplished by a panoramic radiograph, which is a well-recognized, valuable, and widely utilized diagnostic radiograph for routine day-to-day dental examinations, making it an invaluable tool for identi-

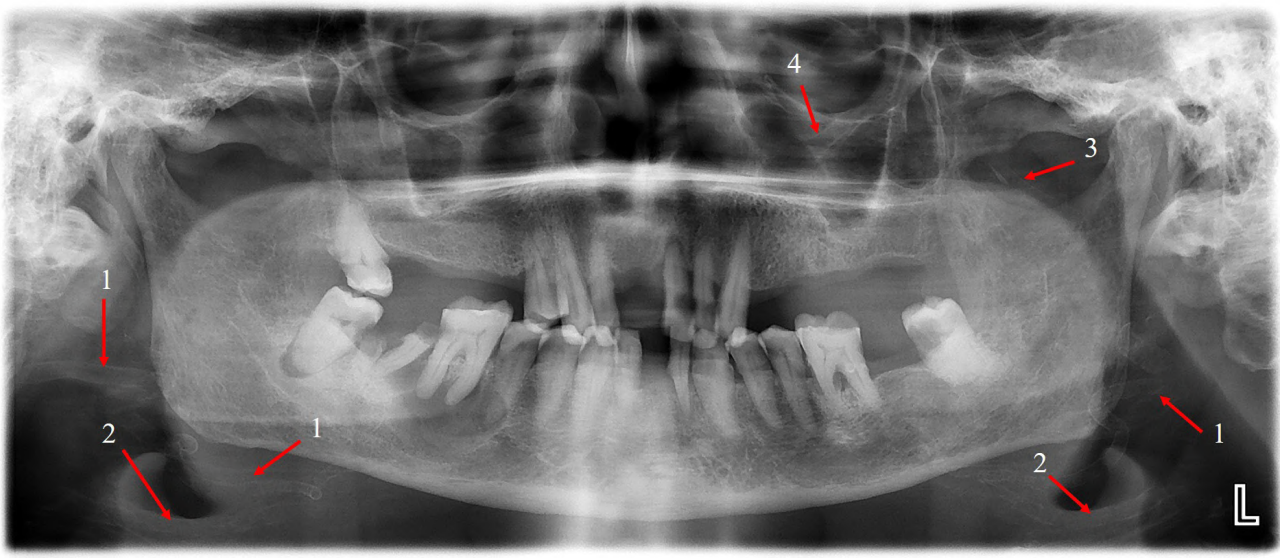

Fig. 2.- Panoramic radiograph shows the tracing of calcification. - Arrow 1 denotes a facial artery; Arrow 2, a lingual artery; Arrow 3, a maxillary artery; and Arrow 4, an infraorbital artery.

Table 1. Incidence and prevalence of calcification in radiographs. PET- Positron emission tomography; CT- Computed tomography; CBCT- Cone beam computed tomography.

S.NO	AUTHOR & YEAR	AGE & GENDER	PATIENT MEDICAL HISTORY	RADIOGRAPHIC IMAGING	RADIOGRAPHIC FINDING
1.	Ennis & Burket, 1942	Not mentioned	Not mentioned	Panoramic	Calcification of cheek artery
2.	Hays et al. 1966	60/ Male	Diabetes mellitus	Periapical and occlusal roentgenogram	Calcification of Facial artery
3.	Miles & Craig, 1983	Median age was 61 years	Hyperparathyroidism Coronary artery disease, and Diabetes mellitus	Panoramic and intraoral	6 case of Calcification of facial artery
4.	Suarez-Cunqueiro et al. 2002	69/Male	Hyperparathyroidism, Renal insufficiency, Hypothyroidism	Panoramic	Calcification of right facial artery Left maxillary, facial and lingual artery
5.	MacDonald et al. 2012	64/Male	Chronic kidney disease, Hyperparathyroidism	Panoramic and CT	Calcification of bilaterally lingual artery, facial artery, the internal maxillary artery, the transverse facial artery and the superficial temporal artery.
6.	Tahmasbi-Arashlow et al. 2016	65/Male	End-stage renal disease, Hyperthyroidism, type 2 Diabetes mellitus, Hypertension, Atrial fibrillation, and secondary Hyperparathyroidism	Panoramic, bitewing, PET, CT	Calcification of bilateral lingual and facial artery
7.	Omami, 2018	59//Male	Diabetes mellitus, Hypertension and kidney transplantation.	Panoramic and CBCT	Calcification of facial artery
8.	Frazier et al. 2018	64/Male	Not mentioned	Panoramic, CBCT	Calcification of facial artery and infraorbital arteries
9.	Fitzgerald et al. 2021	78/Male	Diabetes mellitus, Hypertension, Coronary heart disease	Panoramic, bitewing.	Calcification of facial and maxillary artery
10.	Brooks et al. 2022	90/Female	Hypertension, Hypercholesterolemia	Panoramic	Calcification of facial and infraorbital artery
11.	Current case, 2022	67/Male	Hypertension, Diabetes mellitus, Chronic renal failure	Panoramic	Calcification of facial, Lingual, Infraorbital artery

fying such serious underlying medical conditions and preventing catastrophic adverse events in patients' healthcare.

CONCLUSION

Variations in the normal anatomy may indicate the existence of serious, undiagnosed medical conditions. These variations are often incidental findings on radiographs, and failure to recognize them endangers the patient's health by concealing the situation's critical complexity. Hence, before commencing any invasive procedures, the practitioner obtained a clue about the patient's health status from this atypical picture with calcification.

REFERENCES

BROOKS JK, SHIN K, PRICE JB (2022) Occult Mönckeberg medial calcinosis of the facial and infraorbital arteries in an elderly edentulous patient. *Spec Care Dentist*, 42(6): 642-645.

BYON CH, CHEN Y (2015) Molecular mechanisms of vascular calcification in chronic kidney disease: the link between bone and the vasculature. *Curr Osteoporos Rep*, 13(4): 206-215.

CASTLING B, BHATIA S, AHSAN F (2015) Mönckeberg's arteriosclerosis: vascular calcification complicating microvascular surgery. *Int J Oral Maxillofac Surg,* 44(1): 34-36.

CENTERS FOR DISEASE CONTROL AND PREVENTION (2021) Chronic Kidney Disease in the United States, 2021. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention.

ENNIS L, BURKET L (1942) Calcified vessels of the cheeks: demonstration by means of dental roentgenograms. *Ann Dent*, 1: 111-113.

FISHBEIN MC, FISHBEIN GA (2015) Arteriosclerosis: facts and fancy. *Cardiovasc Pathol*, 24(6): 335-342.

FITZGERALD J, ZIEGLER ME, GREEN PT, NEVILLE BW (2021) Calcified facial and maxillary arteries: Incidental radiographic findings

indicative of Mönckeberg arteriosclerosis. *J Am Dent Assoc*, 152(11): 943-946.

FRAZIER JJ, CASIAN R, BENSON BW (2018) Mönckeberg medial calcinosis of the infraorbital arteries: a first case report. *Oral Surg Oral Med Oral Pathol Oral Radiol*, 125(2): e31-e35.

HAYS JB, GIBILISCO JA, JUERGENS JL (1966) Calcification of vessels in cheek of patient with medial arteriosclerosis. *Oral Surg Oral Med Oral Pathol*, 21(3): 299-302.

KRAMER H, TOTO R, PESHOCK R, COOPER R, VICTOR R (2005) Association between chronic kidney disease and coronary artery calcification: the Dallas Heart Study. *J Am Soc Nephrol*, 16(2): 507-513.

MACDONALD DS, ZHANG L, GU Y (2012) Calcification of the external carotid arteries and their branches. *Dentomaxillofac Radiol*, 41(7): 615-618.

MILES DA, CRAIG RM (1983) The calcified facial artery. A report of the panoramic radiographic incidence and appearance. *Oral Surg Oral Med Oral Pathol*, 55(2): 214-219.

OMAMI G (2018) Calcification of the stylohyoid complex in Libyans. *Saudi Dent J*, 30(2): 151-154.

PLUMP AS, SMITH JD, HAYEK T (1992) Severe hypercholesterolemia and atherosclerosis in apolipoprotein E deficient mice created by homologous recombination in ES cells. *Cell,* 71(2): 343-353.

RUSSO D, PALMIERO G, DE BLASIO AP, BALLETTA MM, ANDREUCCI VE (2004) Coronary artery calcification in patients with CRF not undergoing dialysis. *Am J Kidney Dis*, 44(6): 1024-1030.

SCHINKE T, MCKEE MD, KIVIRANTA R, KARSENTY G (1998) Molecular determinants of arterial calcification. *Ann Med*, 30(6): 538-541.

SPEER MY, YANG HY, BRABB T (2009) Smooth muscle cells give rise to osteochondrogenic precursors and chondrocytes in calcifying arteries. *Circ Res*, 104(6): 733-741.

SUAREZ-CUNQUEIRO MM, DUKER J, LIEBEHENSCHEL N, SCHÖN R, SCHMELZEISEN R (2002) Calcification of the branches of the external carotid artery detected by panoramic radiography: a case report. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*, 94(5): 636-640.

TAHMASBI-ARASHLOW M, BARGHAN S, KASHTWARI D, NAIR MK (2016) Radiographic manifestations of Mönckeberg arteriosclerosis in the head and neck region. *Imaging Sci Dent*, 46(1): 53-56.