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Case Report

Sialolith as an unforeseen finding in CBCT imaging: A case report

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Abstract

Sialolithiasis, characterized by the formation of calculi within the salivary glands, is a prevalent etiology of recurrent edema and discomfort in the oral cavity. Conventional diagnostic modalities, such as physical examination and standard radiography, often fail to deliver the requisite diagnostic specificity and comprehensive detail for optimal diagnosis and therapeutic strategizing. This case report underscores the pivotal role of Cone Beam Computed Tomography (CBCT) in the detection, precise localization, and management of sialoliths, highlighting its superiority over traditional imaging techniques.

Keywords: Sialolithiasis, Cone beam computed tomography, Submandibular gland, Sialography, Sialolith, Radiology.

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1. Introduction

Sialolithiasis is a pathological condition marked by the development of calcified concretions within the salivary ducts, with the submandibular gland being the most frequently affected.[1] This condition can lead to dolorous edema, bacterial infection, and obstruction of the involved gland, necessitating timely diagnostic assessment and therapeutic intervention.[2]

Sialolithiasis exhibits a marked predilection for the submandibular gland, with an occurrence rate of approximately 80%, followed by the parotid gland at 19%, and the sublingual gland at a mere 1%.[3] This condition is most commonly observed in individuals between the ages of 30 and 60 years.[2] Moreover, there is a notable gender disparity, with males being affected at twice the frequency of females.[4]

Pain and swelling in the afflicted gland are among the clinical symptoms.[5] The symptoms will be severe if the duct is completely blocked. Pain and swelling, may he recurrent and most pronounced during meals.[6]

Although a thorough clinical evaluation may arouse suspicion regarding the presence of sialoliths, superimposition and geometric distortion inherent in conventional radiographs render their detection exceedingly challenging.[7] Sialography is commonly employed to identify sialoliths once a diagnosis is established; however, its diagnostic precision and resolution are often constrained, as it fails to provide an exact localization, quantification, or delineation of the stone's anatomical relationship with adjacent structures.[8]

Cone beam computed tomography (CBCT) has emerged as a valuable diagnostic tool in dentistry and maxillofacial imaging, offering high-resolution images and 3D reconstruction capabilities.[5] It aids in superior visualization of the pathology providing accurate dimensions and relation to surrounding structures.[1]

However, if painless they typically go unnoticed during clinical examinations and they could be discovered during routine investigations as accidental discoveries.[2] Nevertheless, if left untreated might result in major consequences and may cause infections.[3]

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This case report discusses the diagnostic utility of CBCT in assessing sialolithiasis.

2. Case Presentation

A 45-year-old male patient was referred for a routine Cone Beam Computed Tomography (CBCT) scan to assess the implant placement sites at the edentulous regions. The imaging was conducted using the Carestream Select 9300 CBCT system (Carestream Dental LLC, Atlanta, GA, USA), a state-of-the-art unit designed for high-resolution, low-dose 3D imaging. The scan was performed under the following imaging protocol: a scan duration of 11–12 seconds, with a current of 8 mA and a tube voltage of 90 kVp.

Notably, the CBCT system automatically adjusts the milliampere (mA) setting based on the patient's anatomical characteristics, thereby optimizing the image quality and minimizing radiation exposure. The scan was captured at a voxel size of 0.2 mm, providing exceptional spatial resolution, and was set with an 8×8 cm field of view (FOV) to ensure comprehensive coverage of the target areas.

Post-acquisition, the images were processed and analysed using the Kodak Dental CS 3D Imaging Software V3.5.7.0 (Carestream Health Inc., Rochester, NY, USA), which enabled detailed evaluation and interpretation of the acquired data. The software facilitated the generation of precise 3D reconstructions, allowing for an in-depth assessment of the anatomical structures and aiding in the treatment planning process for dental implant placement.

Multiplanar reconstruction was achieved by visualizing them in axial, sagittal & coronal planes. While routine evaluation, an incidental finding was detected.

In the 3- D image it was appraised that a well- defined mass was noted adjacent to the lingual cortical plate. The Buccal and Lingual Cortical plates were intact with no signs of erosion. The mass was present as a separate entity from the mandible.

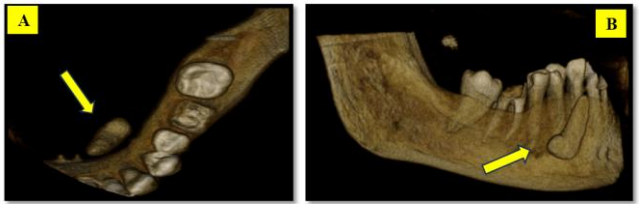

Figure 1: A): 3-D image depicting the top view of a Sialolith; **B):** 3-D image depicting Sialolith from the Lingual Aspect

In the axial section, a single well- defined oval radiopacity was noted adjacent to the lingual cortical plate on left side of mandible at teeth sites 34, 35 region. It is measuring about 11.4mm × 7.3 mm in its greatest dimensions. (**Figure 2**A & 2B)

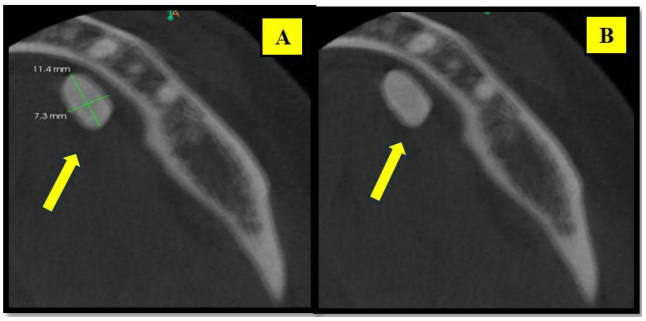

Figure 2: A): Axial images of the Sialolith with measurements; **B):** Axial image of Sialolith without measurements

Upon reviewing the cross-sectional imaging, it was ensured that the pathology did not exhibit any direct contact with the lingual cortical plate. The lesion was localized within the premolar-molar region, suggesting a likely diagnosis of sialolithiasis affecting the left submandibular gland. (**Figure 3**)

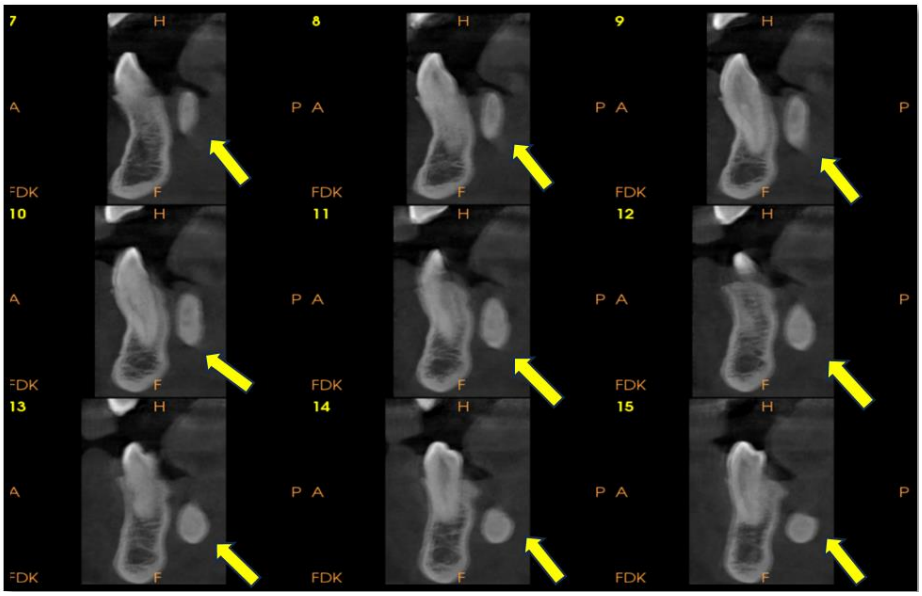

Figure 3: Cross-sectional views of Sialolith

Additionally, the patient was meticulously briefed regarding his condition, which was incidentally identified during the diagnostic evaluation. A detailed and thorough explanation was offered, ensuring that the patient comprehended the nature of the finding and its potential implications for his overall health.

3. Comparative Evaluation with Alternative Diagnostic Imaging Modalities

While traditional panoramic radiographs are capable of detecting large sialoliths, they frequently lack the capacity to offer detailed spatial delineation, particularly concerning the precise localization of the calculus within the ductal system.[5] In contrast, cone-beam computed tomography (CBCT), with its superior resolution and three-dimensional imaging capabilities, facilitated a more accurate assessment, thereby informing and directing the surgical strategy.[6]

4. Discussion

Sialoliths are pathological aggregations of calcium salts, predominantly in the form of hydroxyapatite (calcium phosphate), accompanied by trace amounts of magnesium carbonate and ammonium.[7] Wakely delineated the distribution of sialoliths as follows: 64% occur within the submandibular gland and its duct, 20% within the parotid gland and duct, and 16% within the sublingual gland and duct.[8] The majority of sialoliths typically measure up to 5 mm in maximum diameter, with those exceeding 10 mm being categorized as of atypical size.[9] Furthermore, sialoliths are designated as "giant" when any of their dimensions surpass 15 mm.[3]

Sialolithiasis is most commonly seen in the submandibular gland because of the unique structure of its duct system, which has a longer, upward path and thicker saliva.[9] While standard x-rays, like panoramic and occlusal views, can show the presence of visible stones in the gland, they often don't have enough detail to assess the exact relationship between the stone and the duct system.[10]

Cone Beam Computed Tomography (CBCT) is a highly effective imaging technique for diagnosing sialolithiasis because it produces detailed, high-resolution images and can create 3D models.[6] CBCT clearly shows the size, location, and shape of the stone, helping with precise planning before surgery.[7] It also allows the clinician to evaluate how much the duct is affected and whether surrounding tissues are damaged, which is important for deciding the best treatment, such as removing the stone or widening the duct.[8]

Furthermore, the low radiation dose associated with CBCT, particularly when using a small FOV, makes it a preferable option in comparison to conventional CT scans, which deliver higher radiation doses.[5] In this case, the CBCT scan provided invaluable information which the patient was unaware about and this helped in exact diagnosis of his finding along with exact location and size of the pathology additionally preventing any complications.[3]

5. Etiology

Although the precise etiology remains elusive, sialoliths are believed to develop due to the deposition of mineral salts around an initial nidus, which typically consists of salivary mucin, bacterial entities, or desquamated epithelial cells.[8] These calculi form as a consequence of the mineralization of debris that accumulates within the ductal lumen.[4] This debris may comprise bacterial colonies, exfoliated ductal epithelial cells, mucus plugs, foreign bodies, or other cellular detritus.[3]

Contributing factors to the formation of sialoliths include the stagnation of salivary flow, dehydration, alterations in salivary pH associated with oropharyngeal infection, impaired solubility of crystalloid substances, elevated alkalinity, increased calcium concentrations, and physical trauma to the salivary duct or gland.[2] The exact etiology in the present cases, however, remains undetermined.[1]

Sialolithiasis of the submandibular gland is typically asymptomatic in its early stages.[3] However, symptoms can manifest as pain and swelling of the affected gland, resulting from the obstruction of Wharton’s duct lumen by a salivary calculus, leading to the accumulation of saliva.4 Recurrent infections may arise as a consequence of bacterial ascension into the glandular parenchyma.[5]

6. Management

The primary objective in the management of sialolithiasis should be the preservation of glandular function, alongside minimizing risk and discomfort for the patient.[6] The preferred treatment approach is determined by factors such as the size, location, and number of sialoliths present.[7]

For smaller stones, the application of moist, warm heat, along with the administration of sialagogues and glandular massage, may aid in expelling the stone from the duct.[8] Minor sialoliths can be extracted through the ductal orifice using bimanual palpation.[9] In cases of infection, appropriate antibiotic therapy should be administered, and, when necessary, these instances should be managed with a straightforward sialo lithotomy procedure.[10]

When non-invasive methods fail, primarily due to the size and location of the stones, sialoliths are managed through open surgical interventions.[12] These may involve a transoral ductal incision, purely external approaches, or a combination of both.[11] Additionally, an endoscopy-assisted transoral technique may be employed for the removal of larger or impacted stones, offering a minimally invasive alternative.[13]

The literature also highlights similar cases that emphasize the importance of CBCT in the early diagnosis of sialoliths. Early detection through CBCT plays a crucial role in preventing potential complications associated with these

conditions. These cases underline the value of advanced imaging techniques in improving patient outcomes.

In a case report by Putra DS et al., a 27-year-old female patient was referred for a CBCT radiograph examination due to complaints of swelling and pain in the right lingual area of the mandible.[14] The radiograph findings revealed an irregular, well-defined radiopaque lesion in the lingual area of regions 44-45, measuring 34.31 mm². The lesion was not associated with the mandible. Intra-oral examination showed irregular swelling with the same colour as the lingual mucosa in the region of 44-45. Based on the analysis, the lesion was identified as being located within the salivary duct of the sublingual area, and the patient was diagnosed with right-sided sublingual sialolithiasis. The importance of CBCT examination in precisely detecting the site, quantity, and morphology of sialoliths is exhibited.

In an analogous manner, Tassoker M a report of two cases unveil that a 48-year-old female presented with pain at a maxillary implant site and swelling on the left mandible during meals for two years. A panoramic radiograph showed an osteosclerotic area and a radiopaque mass in the left mandibular angle.[15] CBCT confirmed a submandibular sialolith (5.15 x 5.13 x 2.8 mm) and maxillary implant penetration into the nasopalatine canal. The patient was scheduled for surgical removal of both. Similarly, a 64-year-old female with hypertension and hyperthyroidism was referred for tooth loss. An orthopantomogram showed a radiopaque mass on the left mandible, and CBCT confirmed a sialolith (11.62 x 12.32 x 8.20 mm) in Wharton's duct. She was referred for surgical removal. This case report also emphasizes on the importance of CBCT as a valuable diagnostic modality in cases of Sialoliths.

According to Drage NA et al., reported the cases of three patients in whom salivary calculi migrated to the surface of the skin. In two of these cases, the stones were successfully removed under local anaesthesia.[2] Unfortunately, the third patient was lost to follow-up. Amongst them two submandibular stones were found and one case of a parotid stone that followed to the skin surface. Unlike us the case report focussed on the surgical removal of the sialoliths and did not focus on any radiographic imaging techniques like CBCT.

7. Conclusion

This case emphasizes the indispensable role of Cone Beam Computed Tomography (CBCT) in the diagnostic and therapeutic management of sialolithiasis. CBCT affords superior imaging attributes, offering high-resolution, precise, and comprehensive visualization of sialoliths and their contiguous anatomical structures. With its capacity for 3D reconstruction, minimal radiation exposure, and exceptional detail, CBCT emerges as an invaluable diagnostic adjunct for clinicians, facilitating precise treatment planning and optimizing patient prognoses. In light of these merits, CBCT should be regarded as the imaging modality of choice for evaluating sialolithiasis, particularly in complex or diagnostically challenging scenarios.

8. Source of Funding

None.

9. Conflict of Interest

None.

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