

**MULTIPLE CASES OF SUBMANDIBULAR SIALOLITHIASIS DETECTED BY  
CONE BEAM COMPUTED TOMOGRAPHY**

**KONİK IŞINLI BİLGİSAYARLI TOMOGRAFİ İLE TESPİT EDİLMİŞ MULTİPLE  
SUBMANDİBULAR TÜKÜRÜK BEZİ TAŞI VAKALARI**

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**ABSTRACT**

**Objective:** Salivary gland stones can be detected with different diagnostic methods. The purpose of this article was to report four cases of submandibular sialoliths that were detected by flat panel-based Cone Beam Computed Tomography (CBCT) and provide useful diagnostic information for dentists.

**Patients and methods:** Radiographic findings of four cases of submandibular sialolithiasis were detected and assessed by using flat panel-based CBCT. The cases were involved of two giant calculi that one of bilateral, two minor submandibular sialolithiasis.

**Conclusion:** This report shows the way to the importance of CBCT in the detection, location and measurement of submandibular sialolithiasis. Although it cannot provide additional information about relationship between the sialolith and surrounding soft tissue, its precise accuracy in detecting of location and measurement of stones should not be ignored.

**Key words:** sialolithiasis, cone beam computed tomography, submandibular gland

**ÖZET**

**Amaç:** Tükürük bezi taşları farklı görüntüleme yöntemleri ile tespit edilebilir. Bu makalenin amacı konik ışınli bilgisayarlı tomografi (KİBT) ile saptanmış 4 submandibular tükürük bezi taşı vakası rapor etmek ve diş hekimlerine tanı açısından yararlı olabilecek bazı bilgiler sunmaktır.

**Hastalar ve metot:** Flat panel esaslı KİBT ile tespit edilmiş 4 submandibular tükürük bezi taşı vakası değerlendirildi. Vakalar biri bilateral olmak üzere 2 majör, 2 minör tükürük bezi taşı olgusunu içermekteydi.

**Sonuç:** Bu makale KİBT'nin submandibular tükürük bezi taşlarının saptanmasında, lokalize edilmesinde ve boyutlandırılmasındaki önemine ışık tutmaktadır. KİBT her ne kadar taşın çevre yumuşak dokularla ilişkisi hakkında yeterli bilgi sağlayamasa da taşların lokalizasyon ve büyüklüğünün tespitindeki tam doğruluğu göz ardı edilmemelidir.

**Anahtar Kelimeler:** tükürük bezi taşları, konik ışınli bilgisayarlı tomografi, submandibular tükürük bezi

Sialolithiasis is the most common disease of salivary gland in middle-aged patients. Males are affected twice as often as females, children are rarely affected.<sup>1,2</sup> More than 80% of sialoliths occur in the submandibular gland or its duct, 4–10% occur in the parotid gland, and 1–7% occur in the sublingual gland or minor salivary glands.<sup>1,3</sup>

The clinical symptoms are that of obstruction manifested by pain and swelling of the involved gland during eating when salivary flow is stimulated against a fixed obstruction.<sup>4</sup> Commonly, sialoliths

measure from 1 mm to less than 1 cm and they rarely measure more than 1.5 cm.<sup>2,6</sup> Giant sialoliths are rather uncommon. Bilateral sialoliths are also uncommon, occurring in 2.2% of cases.<sup>3,7</sup>

The algorithm for imaging the salivary glands depends on the clinical scenario with which the patient presents to the clinician. Because the causes of the symptoms can be complex, identifying small calculi in the gland or salivary duct is important in order to identify the real cause.<sup>8</sup> Occlusal radiographs are particularly useful for the diagnosis of radioopaque submandibular sialolithiasis.<sup>1,7</sup> Sialography has up

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to 100% diagnostic accuracy. However its use is contraindicated in acute infections and orifice stones.<sup>7,9</sup> Extraoral transcutaneous ultrasonography can also show the locations of even radiolucent stones and be used in patients with acute sialadenitis.<sup>10</sup> Magnetic resonance (MR) imaging is not useful for the detection of stones.<sup>11</sup> However it may depict the status of the gland parenchyma affected by sialolithiasis. That is to say, it may reflect the chronic and acute nature of the obstruction. MR sialography could replace the conventional sialography in depicting the dilated duct and also sialolith in it. Sialoendoscopy can be used for both diagnostic and treatment purposes.<sup>3</sup>

When other investigations have failed to detect a suspected calculi, computed tomography (CT) can help confirm a diagnosis and localize the stone. CT originally designed as a head scanner, has been used since its development for evaluation orofacial structures. However CT machines have limitations for dentistry including their high cost, large footprint and high radiation exposure.

Cone beam computed tomography (CBCT) is an imaging modality that is becoming an integral part of many dental practices. While much of the early focus has been on its use in dental implantology, it has proved to be a valuable asset in the diagnostic assessment of oral and maxillofacial pathology.<sup>12,13</sup> It also allows the use of a shorter scanning time whilst the radiation dose is up to six times lower compared with conventional CT scans. This article reports four cases of submandibular sialoliths that were described by flat panel-based CBCT.

## Case reports

### Case 1

A 59-year-old female was referred to our clinic for tooth loss and prosthetic requirement. She did not have any systemic diseases nor did she use any drugs. During routine radiographic examination, a large radiopacity was detected under the right angle region of the mandible (Fig. 1a). When panoramic radiography was repeated to eliminate possible artifacts, the same opacity was again seen in the same region. There were no abnormal findings in the extraoral examination. Intraoral examination indicated that the duct orifice appeared normal, and bimanual palpation revealed a hard mass. CT scans with axial, coronal, and sagittal cross-sectional cuts perpendicular to the alveolar ridge, and 3D images were performed with CBCT (NewTom FP, Verona, Italy) with 110 kVp,

15 mA, 36 seconds irradiation time, 17 cm diameter-13 cm height scan volume and suspicions were confirmed (Figs. 1b, 1c, 1d, and 1e). The giant sialolith measured 35.2 x 14.0 x 12.3 mm. The patient had not complained of pain, swelling, and xerostomia.

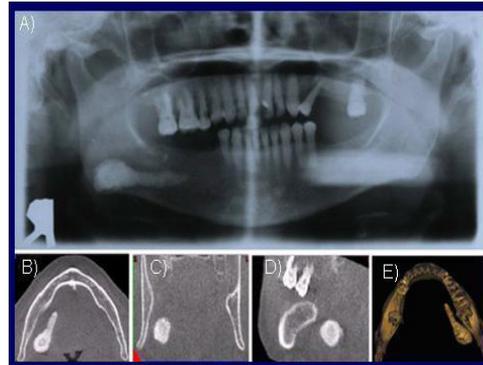


Figure 1. Panoramic, axial, coronal, sagittal and top 3D images show the major sialolithiasis in the right mandible.

### Case 2

A 59-year-old male was referred to our clinic for a hard mass on the left floor of the mouth. He had a history of swelling during eating. The intraoral examination revealed a hard palpable sialolith. Radiographic examination revealed a large radiopacity appeared under the left angle region of the mandible during routine radiographic examination (Fig. 2a). CBCT evaluation showed submandibular sialoliths (Figs. 2b, 2c, 2d, and 2e). The giant sialolith measured 22.0 x 9.5 x 11.2 mm. The patient accepted treatment and was referred to the Department of Oral and Maxillofacial Surgery.

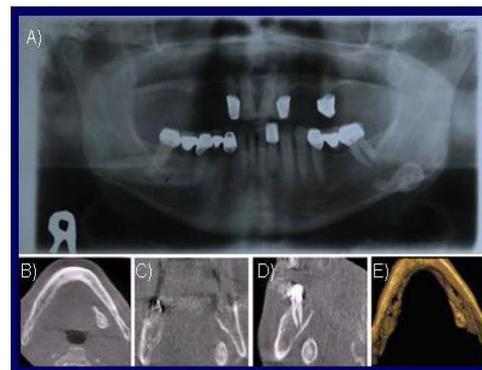


Figure 2. The view of major submandibular gland stone in the different images.

### Case 3

A 48-year-old female was referred to our clinic for dental caries and tooth loss. On routine panoramic radiograph, a bilateral radiopacities were seen under the angle of the mandible and bilateral submandibular sialolithiasis were suspected (Fig. 3a). The duct orifices also appeared normal. The left sialolith was revealed upon bilateral bimanual palpation of the floor of the mouth. CBCT revealed the presence of bilateral sialoliths (Figs. 3b, 3c, 3d, and 3e). The bilateral sialoliths were observed on the coronal, axial, and cross sections in the right and left submandibular regions, which measured 4.5 x 6.8 x 4.8 mm and 7.5 x 7.2 x 6.1 mm, respectively. They were asymptomatic; patient had no complaints of swelling, pain, and xerostomia.

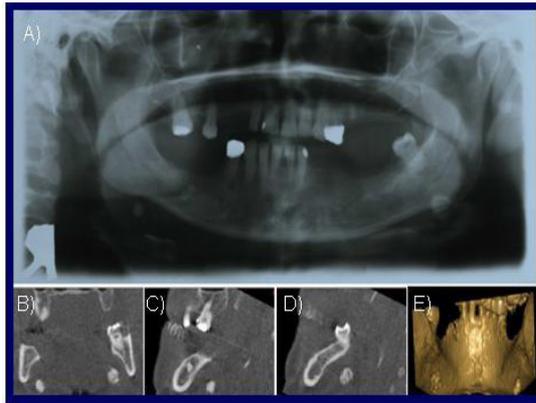


Figure 3. Bilateral sialolithiasis

### Case 4

A 45-year-old female was referred to our clinic for periodontal problems. On routine panoramic radiograph, a radiopacity was noticed under the left angle region of the mandible and sialolithiasis was suspected. It was asymptomatic; she had no complaints of swelling, pain, and xerostomia. The duct orifice also appeared normal and there were no abnormal findings in palpation of the submandibular gland and floor of the mouth. CT scans with axial, coronal, and sagittal cross-sectional cuts and 3D images were performed with CBCT (Figs. 4a, 4b, 4c, and 4d). The sialolith measured 7.1 x 7.5 x 5.5 mm.

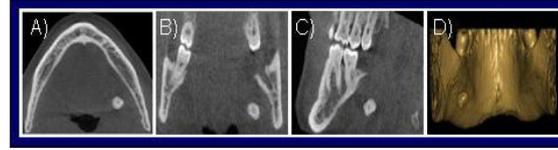


Figure 4. The example of minor sialolithiasis

## DISCUSSION

Sialolithiasis is the most common salivary gland disease in adults however the exact etiology and pathogenesis of sialolithiasis is still unknown. Males are more frequently affected than females. On the contrary, three of our patients were females in the present report. Sialolithiasis appears more frequently in the third to sixth decade of life; children are rarely affected.<sup>1,2,14</sup> Case 1 and case 2 were in their sixth decade; case 3 and case 4 were in their fifth decade of life, consistent with the literature.

It is reported that sialoliths rarely measure more than 1.5 cm. The largest sialolith, which measured 70 mm, was reported by Cavina and Santoli<sup>15</sup> in 1965. In the present report, the sialoliths measured 35.2 mm and 22 mm in the case 1 and case 2 cases, respectively. Giant sialolithiasis usually locates in the submandibular gland since its excretory duct is longer and wider; saliva in the submandibular gland flows against gravity; its secretion is more alkaline; and it contains a higher quantity of mucin proteins, calcium, and phosphate.<sup>5</sup> In the present cases, all of the sialoliths were located in the submandibular gland. Sialolithiasis usually appears unilaterally; and bilateral submandibular sialolithiasis is rather rare. There are a few reports of bilateral submandibular sialolithiasis in the literature.<sup>7</sup> In this article Case 3 presented a case of bilateral submandibular sialolithiasis.

Sialolithiasis typically causes pain and swelling of the involved salivary gland due to obstruction of salivary secretion.<sup>15</sup> However if the duct adjacent to the stone is able to dilate, allowing nearly normal secretion of saliva around the stone, it might be asymptomatic for a long period until eventually a giant stone is created.<sup>6</sup> In the present report three of our patients were also asymptomatic, and the sialoliths were diagnosed incidentally; only the second patient had a history of swelling and pain. As stated in the literature,<sup>6</sup> if the duct adjacent to the stone is able to

dilate, allowing nearly normal secretion of saliva around the stone, it might be asymptomatic for a long period until eventually a giant stone is created.

Submandibular sialolithiasis can be visualized by different techniques as we mentioned in introduction. In our study, in addition to panoramic radiographs, we used flat panel detector-based CBCT for diagnosis and location. Compared with conventional techniques, and according to our current findings, CBCT was highly sensitive in showing the location and size of sialoliths. Due to inherent factors, panoramic images could be both distorted and magnified, which means that unreliable results could be produced when measuring distance on panoramic x-rays, even when the magnification factor is known. The advantage of CBCT is that it creates images that are not only dimensionally faithful, but also anatomically accurate, as well.<sup>12,16</sup>

CBCT units are much smaller than medical CTs, are less expensive to purchase and to operate, they produce a fraction of the radiation dose, and possess an open architecture that eliminates patient complaints of claustrophobia.<sup>12,17,18</sup> According to recommendations of the International Commission on Radiological Protection (ICRP), although the doses from CBCT are low compared with medical CT, the increased effective dose for salivary glands with both techniques is a weighted issue.<sup>19</sup> In addition, the main limitation of CBCT in diagnosing sialolithiasis is the lack of a soft tissue window compared to medical CT.<sup>17</sup> In all existing cases, CBCT could not provide additional information, such as the sialolith's relationship with soft tissue, or the narrowing or dilatation of Wharton's duct. On the other hand, medical CT is often the best initial study for the evaluation of a painful gland, including the soft tissue. Sialography is an excellent modality for demonstrating duct anatomy and the presence of stones and strictures. The added advantage of sialography is that an assessment of the suitability of the ductal system for interventional sialographic procedures can be made and that radiolucent stones may also be identified. Extraoral transcutaneous ultrasonography can also show the locations of even radiolucent stones and be used in patients with acute sialadenitides.<sup>10</sup>

Drage and Brown<sup>18</sup> described the use of cone beam sialography in two patients with salivary gland obstruction. They suggested this technique when plain

film sialography is suspected to be, or has been found to be, inadequate in imaging the more complex cases of salivary duct obstruction. However, additional studies are needed to evaluate the ratio of advantages/disadvantages between this technique and traditional sialography.

In conclusion, CBCT provides useful information for the measurement and location of submandibular sialolithiasis. However it cannot provide additional information about relationship between the sialolith and surrounding soft tissue. Therefore, other advanced forms of imaging, such as medical CT and sialography techniques may be effective, especially in cases of sialolithiasis where treatment is considered.

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