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Prevalence of Stafne's Bone Cavity – Retrospective Analysis of 14,005 Panoramic Views

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Abstract. *Aim: Stafne's bone cavity (SBC) is a very rare defect, affecting only selected parts of the mandibular bone. Its etiology is unknown. On two-dimensional images, it appears as a narrowed cavity and might be interpreted as a space-occupying process inside the bone. The aim of the present study was to investigate the prevalence of SBC on panoramic views, and compare these results to published reports. Materials and Methods: A total of 14,005 panoramic views were examined retrospectively with regard to the presence of SBC. All images were analyzed regarding typical characteristics as originally described by Stafne. Results: A total of 11 cases fulfilled diagnostic criteria of SBC (0.08%). All patients were men (100%), at a mean age of 58.1 years (range=38-75 years). Eight patients (72.7%) had SBC on the left side, three patients on the right side (27.3%). In eight cases, SBC was found in the mandibular corpus (72.7%), and in three cases in the mandibular angle (27.3%). Correlating with published results, SBC was found at a relative frequency of 0.13%. Conclusion: SBC on panoramic views or other imaging modalities should alert the clinician to exclude other potential pathologies. In doubtful cases, surgical procedures might be necessary to verify the diagnosis.*

The term Stafne's bone cavity (SBC) describes a localized bone defect, predominantly affecting the mandibular bone. SBC is special matter of the osseous cavity, beneath the nerve canal, and appears as a bright structure on x-ray images. SBC was named after Edward C. Stafne who first described it. He described 35 asymptomatic unilateral radiolucent cavities in the posterior region of the mandible (1). Stafne's description of these bone cavities remains in use today: a round or oval structure with a diameter of 1 to 3 cm, mostly located beneath the mandibular canal (1).

Due to the fact that SBC does not cause any symptoms, in most cases, they become mostly visible accidentally on panoramic views during routine performance (2). SBC is more frequently seen in males, mostly occurring unilaterally, and is predominately diagnosed in adults (3-9). In most cases, patients are between the age of 50 to 70 years; only in very rare cases are patients younger than 20 years (10, 11). The youngest patient ever in whom SBC was reported was 11 years old (12, 13). Differential diagnosis has to include neoplastic bone cysts, and cyst-like lesions, such as solitary bone cysts (solitary jaw cyst), aneurysmatic bone cysts, and traumatic-hemorrhagic bone cysts (14-16). However, the radiological profile is quite specific.

SBCs are usually located inside cancellous bone of the mandible. In very rare cases, SBCs can be palpated, due to the fact of the missing bone surface (12). In contrast to real cysts, SBCs do not exhibit any epithelial lining of the cavity. In all operated cases, no cystic bellows or fluid material were found (2). Due to the radiological appearance, the lesions were erroneously described as cystic lesions, and the term 'Stafne's cyst' was created (17). There exist several other names for SBC (18-28).

The description of a latent or stable osseous lesion is due to its persistence over a long period without any changes (29, 30). In recent times, repeated radiological examinations over a longer period demonstrated that changes of size and diameter can be determined in SBC. The etiology of SBC is unknown. Speculations concerning the development of SBC involve atrophy of the mandibular bone, induced by pressure of the dorsal part of the submandibular gland; displacement of the sublingual gland; functionally-related osseous changes; resorption of the bone, induced by inflammational or evolutional inclusions of gland tissues into the bone or aneurysmatic changes of the facial or inferior alveolar

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Table I. *Review of the literature: relative frequency of Stafne's bone cavity (SBC).*

Author(s) (Ref)	Year of publication	Analyzed cases	Number of SBCs	Rate of SBC (%)
Lilly *et al*. (23)	1965	1,283	2	0.16
Karmiol and Walsh (19)	1968	4,693	18	0.38
Johnson (17)	1970	2,486	10	0.40
Oikarinen and Julku (28)	1974	10,000	10	0.10
Uemura *et al*. (47)	1976	3,000	10	0.33
Correl *et al*. (6)	1980	2,693	13	0.48
Chen and Ohba (4)	1981	23,000	24	0.10
Sisman *et al*. (42)	2012	34,221	29	0.08
Current study	-	14,005	11	0.08
Total		95,385	127	0.13

arteries (29, 30). Dimensions of SBC are reported between 5 and 30 mm (30). In several cases, through biopsies and histological verification, next to fatty and glandular tissues, muscular tissue and blood vessels have been described (6, 8, 31, 32). Gomez *et al*. verified glandular tissues inside SBC by sialography in three cases, and the origin of the soft tissue from outside the bone in six cases by computed tomography. In two out of four surgically treated cases, exploration and histological examination verified glandular tissues; two cavities were empty (4).

Histological results have provoked numerous discussions concerning the etiology of SBC. Currently, it is assumed that pressure on the mandibular bone, induced by an enlarged submandibular gland, is causative for the development of SBC (10). However, displacement of the submandibular gland, if no longer separated by the mylohyoid muscle, could also induce bone resorption (5). The submandibular gland preferentially induces posterior-lingual cavities, whereas anterior lingual cavities are induced the sublingual gland (6, 33, 34). Further causative surrounding structures might be lymph nodes, muscles or the facial artery (17). SBC might alternatively be induced by aneurysms, which can be caused by enlarged blood vessels, malformation of blood vessels, or dysplasia of the mylohyoid ramus of the inferior alveolar artery (9, 17, 18, 35).

Typically, SBCs are localized in the distal part of the mandibular corpus or the region of the mandibular angle, beneath the mandibular nerve (36). Very rarely, SBCs have been found in the ramus, the coronoid process or in the frontal parts of the mandible and were described under the term mandibular bone depression (MBD) (6, 37). One case has been described in which SBC was found in the buccal aspect of the ramus (38). Further description of these MBDs allows for separation into anterior lingual mandibular bone depression and posterior mandibular lingual bone depression (6, 37), the latter being found more often (ratio 7:1) (37).

Usually, SBC becomes visible in panoramic views during dental or maxillofacial radiological diagnostics. This technique only allows two-dimensional evaluation of the lesion. In recent years, through newer radiological investigational methods, such as cone beam computed tomography (CBCT), computed tomograpy (CT), and magnetic resonance imaging (MRI), more sufficient analysis and evaluation of SBCs has become possible.

The purpose of this study was to investigate the etiology of SBCs on panoramic views throughout a large patient group localized in the northern part of Germany, and to compare these results to recent studies in the literature.

Materials and Methods

Over a period of three years (2008-2010) 14,005 panoramic views were performed at the local Department of Dental Radiology. All images were evaluated by one dentist, one dental radiologist, one orthodontist and two oral and maxillofacial surgeons. All panoramic views were performed and archived on the same radiological device (Orthophos XG; Sirona Dental Systems GmbH, Bensheim, Germany). Digital archiving of patient data was carried out by using a specialized program (Sidexis; Sirona Dental Systems GmbH, Bensheim, Germany). Evaluation of all performed panoramic views was performed regarding the following aspects: The entity of SBC in all patients diagnosed in our Department; the possibility of finding a diversification regarding age and gender our patients; a comparison to data of the literature (Table I).

SBC is a sharply demarcated osteolytic lesion of the mandible, caudal to the inferior alveolar nerve and restricted to the regions of the molars and mandibular angle. In one case, CBCT of the mandible was performed to further characterize the lesion.

This study was approved by the Institutional Board of Eppendorf University Hospital: the results presented here are part of an ongoing study to fulfill the requirements of a medical dissertation in dentistry and the application for study was approved in this objective by the aforementioned board prior to the start of the investigation.

Figure 1. *Panoramic view of a 38-year-old male with Stafne's bone cavity in the left mandibular corpus, with a round form.*

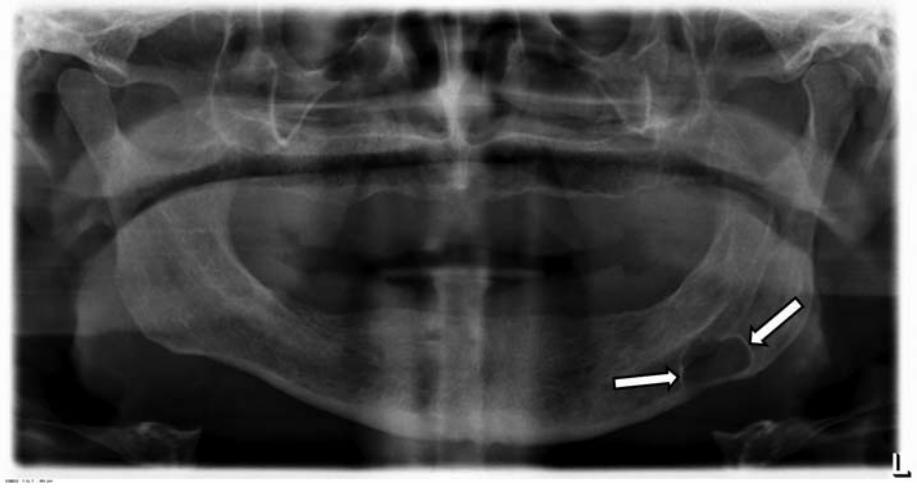

Figure 2. *Panoramic view of a 70-year-old male with Stafne's bone cavity in the left mandibular corpus, with an oval form.*

Results

A total of 11 cases indicative of SBC fulfilled the diagnostic criteria of SBC (0.08%). In 10 patients, radiographic views were sufficient to verify the diagnosis of SBC; in one case, additional CBCT was performed to exclude other pathologies. All 11 cases were men (100%), with a mean age of years 58.1 years (range=38-75 years). With a ratio of 1:2.75, in eight cases SBC was located on the left side (72.7%), in three cases on the right (27.3%). With the same ratio of 1:2.75, SBC was located in eight cases in the mandibular corpus (72.7%) (Figures 1 and 2) and in three cases in the mandibular angle (27.3%) (Figures 3 and 4). In six cases, SBC was located in the left mandibular corpus (54.5%), in two cases in the right mandibular corpus (18.2%), in two cases in the left mandibular angle (18.2%) and in one case in the right mandibular angle (9.1%). In correlation with results in the literature, the collation of our own results with those of other studies, resulted in a total of 127 SBCs found in 95,385 panoramic views. These lead to a relative frequency of 0.13% (Table II).

Discussion

The diagnosis of SBC is usually incidental. On panoramic views, SBCs typically exhibit cystic signs, such as a round

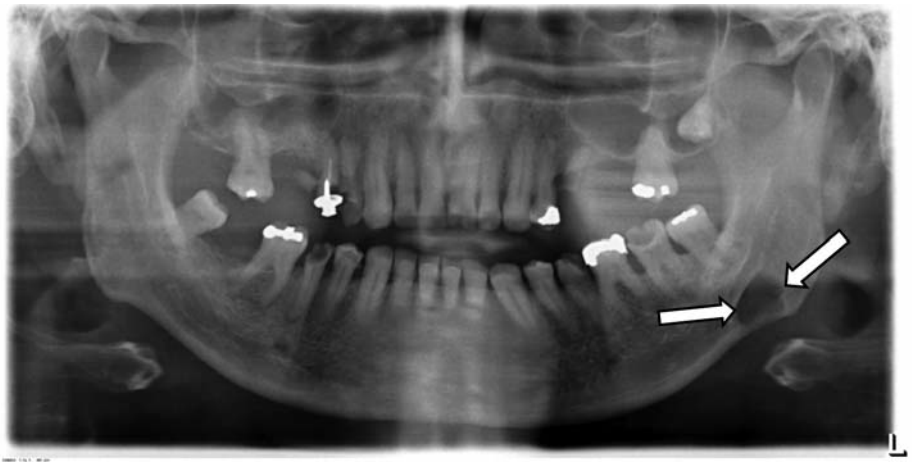

Figure 3. *Panoramic view of a 65-year-old male with Stafne's bone cavity in the left mandibular angle, with an oval form.*

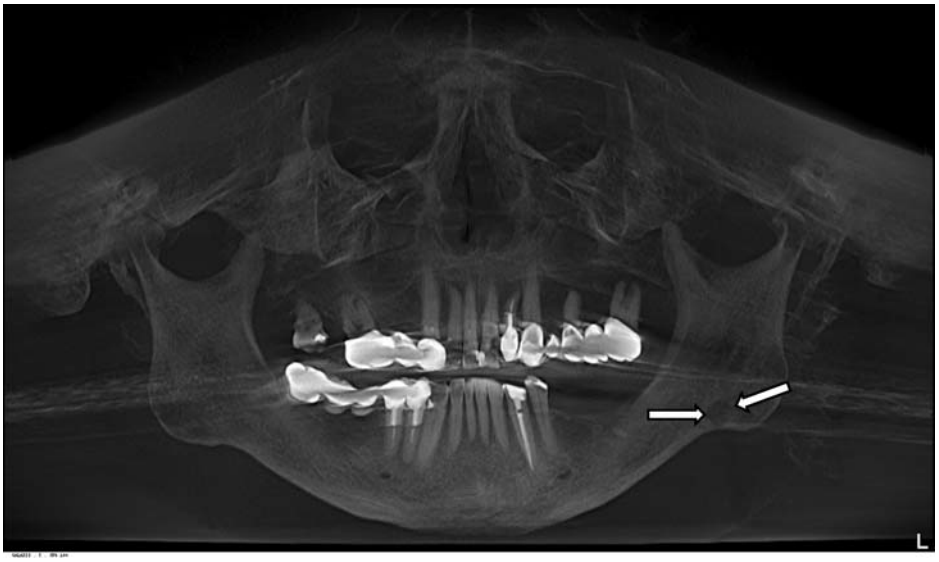

Figure 4. *Cone beam computed tomography of a 73-year-old male patient with Stafne's bone cavity in the left mandibular angle, with a round form.*

or oval, radiolucent lesion, mostly affecting distal areas of the mandibular corpus or the angle, located under the nerve canal (5, 10). The results of our study have been directly compared to larger studies, involving a minimum of 1,000 patients (Table I) (7, 28, 36, 38-43).

Compared to most results in the literature, our results agree with those presented, concerning prevalence (0.08%), localization of SBC, age of patients, and the form and extension of SBC (Table II) (3-10, 12, 30, 36, 37). The only small difference compared to other studies was the male: female ratio (11:0), verifying the major appearance in males (5, 10). In literature, only few cases have been reported in which cystic lesions of the mandibular bone seem similar to SBC, and which were located in typical regions of SBC, *e.g.* an ossifying fibroma (5, 44). Nevertheless, diagnostic differentiation of SBC from similar space-occupying lesions of the mandibular bone is of major importance (3, 6, 45). Other entities requiring consideration are metastases, eosinophilic granulomas, keratocystic odontogenic tumors, giant cell granulomas, ameloblastomas, sialadenomas, myxomas, hemangiomas, and odontogenic cysts. Therefore, in most cases, radiological examination using panoramic views plus further diagnostics, such as CBCT or CT scans are sufficient. In those cases where a clear distinction is not

Table II. *Detailed list of cases positive for Stafne's bone cavity (SBC) on review of panoramic radiographs.*

Case	Type of x-ray	Age (years)	Gender	Localization of SBC	Form	Extension of SBC (mm), sagittal/caudal
1	PR	65	M	Left corpus	Oval	ca. 20/15
2	PR	38	M	Left corpus	Round	Ø ca. 10
3	PR	41	M	Left corpus	Round	Ø ca. 10
4	PR	63	M	Left corpus	Oval	ca. 15/10
5	PR	40	M	Left corpus	Oval	ca. 12/8
6	PR	70	M	Left corpus	Oval	ca. 20/15
7	PR/CBCT	73	M	Left angle	Round	Ø ca. 8
8	PR	59	M	Right angle	Oval	ca. 20/10
9	PR	51	M	Right corpus	Round	Ø ca. 8
10	PR	64	M	Right corpus	Oval	ca. 15/10
11	PR	75	M	Left angle	Oval	ca. 15/25

M: Male; PR: panoramic radiograph; CBCT: cone beam computed tomography.

possible, surgical exploration and histological examination might be necessary to verify this assumption. In all our cases, SBC was clear without ambiguity, hence surgical and histological procedures were not performed. Due to the fact that SBCs are benign lesions, and if patients are free of complaints, surgical procedures are not indicated. Regular check-ups in such cases are strongly recommended since malignant transformation of glandular tissue remains rare but possible (46, 47). If the extension of SBC becomes oversized, imminent risk of spontaneous fractures of the mandible might occur. In those cases, in order to reduce such traumas, therapeutical interventions have to be considered (48).

Conclusion

This study presents the retrospective results of a widely performed analysis of patients seen in one center in Northern Germany. Over 14,000 panoramic views were reviewed, detecting a total of 11 SBCs. Diagnostic suspicion of SBC on a panoramic view, or any other imaging modality, should alert the clinician to exclude potential other pathologies. In selected cases, if enlargement of the lesion is noted, surgical procedures might be necessary to verify the diagnosis.

Conflicts of Interest

None declared.

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