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Clinical Manifestations and Symptoms of Maxillary Sinusitis of Odontogenic Origin Demonstrated by Cone Beam Computed Tomography

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Abstract

Objectives: To compare the symptomatology of patients with maxillary sinusitis of dental origin (MSDO) with sinusitis due to upper respiratory tract infection (URTI) with a special focus on time to correct diagnosis. To define the accuracy of cone beam computed tomography (CBCT) in detecting the dental origin of the sinusitis.

Methods: Retrospective review of the otolaryngology specialist care, primary health care and dental health care medical records of patients with maxillary sinusitis who has been referred for radiology. All patients were examined by CBCT, which has a better resolution regarding bony structures than low-dose computed tomography. To the best of our knowledge there is no previous study on this topic based on CBCT as diagnostic method.

Results: Sixty-one patients were included in the study; of these, 25 had MSDO and 36 had URTI sinusitis. The MSDO patients more frequently reported foul odour and foul taste than patients with URTI sinusitis. The URTI sinusitis patients more frequently reported symptoms such as facial pain, facial congestion and cold-related symptoms. Both the time from the onset of symptoms to the first medical visit and the subsequent time to a correct diagnosis were significantly longer in the MSDO group. The accuracy of CBCT for detecting dental pathology as the underlying cause of sinusitis was 97%.

Conclusion: The present study verifies that maxillary sinusitis of dental origin differs from viral-induced rhinosinusitis concerning symptomatology and clinical findings. Certain findings and symptoms could serve as valuable indicators of an underlying dental pathology, because although MSDO is well known, the present study shows that these patients are often misdiagnosed and the correct diagnose and treatment is often delayed several months. Consequently, better assessment is important. The suspicion of MSDO should be raised for patients with unilateral sinusitis presenting little pain, foul odour or foul taste and a long time course. These patients should be referred for radiology, preferably CBCT, to rule out odontogenic cause. CBCT is easy to perform for sinusitis examinations and has advances to common CT, especially regarding detection of pathology in bony structures as the periapical area. Because of this CBCT is a reliable tool in order to detect maxillary sinusitis of dental origin.

Keywords: Multidetector computed tomography; Cone beam computed tomography; Radiology; Periapical diseases; Periapical abscess; Paranasal sinuses; Maxillary sinuses; Sinusitis; Maxillary sinusitis; Signs and symptoms

Introduction

The relationship between odontogenic infections and maxillary sinusitis is well established [1,2]. The roots of the molars and sometimes also the premolars in the upper jaw are usually situated in close relation to or in direct contact with the maxillary sinus. Odontogenic infections are either endodontic, caused by infections of the dental pulp, or periodontal, involving the supporting tissues of the tooth. Such odontogenic infections require specific dental treatment of their causes. If sinusitis caused by an odontogenic infection is solely treated with antibiotics, the infection often initially subsides but will eventually recur as the infection is not fully treated. Therefore, it is important to identify whether maxillary sinusitis originates from a dental infection [1].

Recent studies using three-dimensional radiologic techniques, such as multi-slice computed tomography (MSCT) and cone beam computed tomography (CBCT), have reported MSDO in up to 40% of chronic sinusitis patients [3,4]. Furthermore, Ly et al. reported that up to 48% of CT-verified unilateral maxillary sinusitis cases were of odontogenic origin [5]. CBCT is a three-dimensional computed tomography method in which hard tissues, such as bones and teeth, can be reproduced in high detail, facilitating good imaging of apical pathology of the maxillary molar teeth. Even small apical defects that may be difficult or impossible to detect with two-dimensional techniques can thus be identified [6-8].

Classic symptoms indicating maxillary sinusitis include facial pain or a sense of fullness, postnasal drip, a foul odour and taste, nasal obstruction, and maxillary toothache [9-11]. The clinical features of MSDO and URTI sinusitis are fairly similar, but the former is usually

unilateral [12]. Given the possibilities of accurately diagnosing periapical disease with CBCT, it is of interest to compare the clinical manifestations of MSDO with those of URTI sinusitis.

The aim of this study was to investigate symptoms and clinical findings in patients with MSDO compared with patients with URTI sinusitis verified *via* CBCT and medical record reviews.

Materials and Methods

All cases of maxillary sinusitis verified by CBCT and medical record review at Sunderby Hospital during 2012 were included in the study. To increase the MSDO sample size, all MSDO cases verified by CBCT and medical records in 2013 were also included (Figure 1). Examinations were identified from the radiological information system (RIS/SECTRA) and imaging data retrieved from the local radiological image archive.

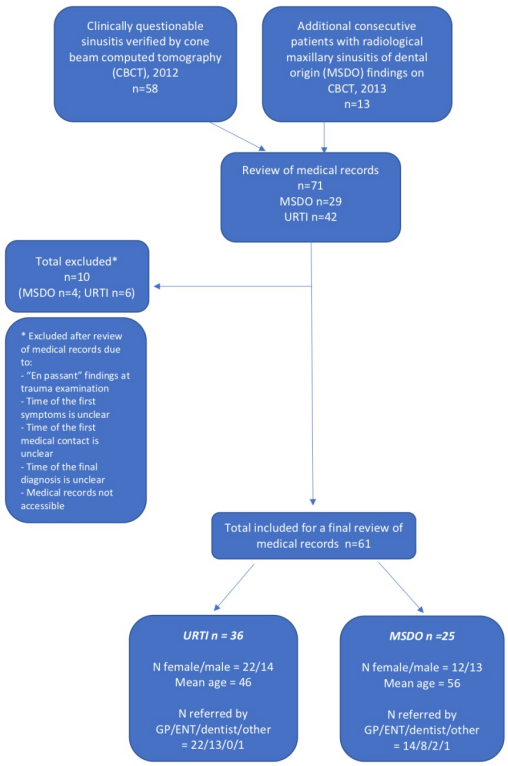

Figure 1: Flow chart showing the demographic data and the distribution of sinus pathology among the patients included in the study. Cone beam computed tomography (CBCT); maxillary sinusitis of dental origin (MSDO); sinusitis associated with upper respiratory tract infection (URTI); ear, nose, and throat specialist (ENT); general practitioner (GP); dentist (maxillofacial surgeon or dentist); other (specialists other than ENTs).

The CBCT examinations and image reviews were performed as described in detail in a previous study by our research group [12] but are briefly described below.

Two observers retrospectively conducted independent reviews of all examinations. In the reviewed cases, when the observers disagreed, the examinations were re-reviewed jointly to reach consensus.

Definition of sinusitis

All patients included in this study had been referred to radiology due to a clinical suspicion of sinusitis which had also been confirmed by CBCT. The various clinical symptoms reported included purulent discharge, nasal congestion, facial pain or sense of fullness.

Pathology detected with CBCT was classified as on-going sinusitis based on the following radiological criteria:

A detected pathology was classified as on-going sinusitis based on the following radiological criteria: Gas/fluid level with or without adjacent mucosal swelling or a totally congested maxillary sinus without other signs of polyposis or tumour.

Sinusitis was classified as unilateral if a strictly unilateral pattern or a clear predominantly unilateral pattern was detected for all sinuses (Figure 2a).

MSDO was diagnosed in cases of periapical destruction or extensive marginal destruction with a clear connection to the affected maxillary sinus (Figure 2b).

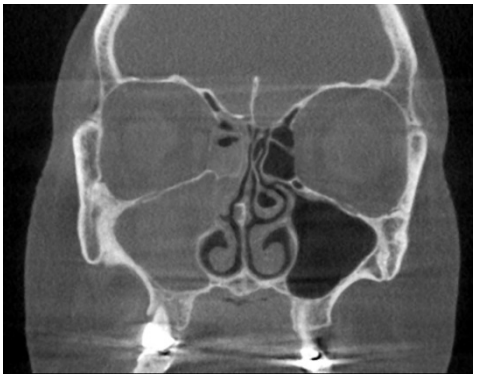

Figure 2a: CBCT examination showing a unilateral pattern of sinusitis on the right side. The left side is normally aerated. This patient was diagnosed having a unilateral sinusitis due to upper respiratory tract infection (URTI).

The medical records of all patients exhibiting radiologically confirmed sinusitis were reviewed. Medical records from all referring clinics (primary health care, otolaryngology specialist care and public dental care) were available in the hospital information system (VAS).

Patient data related to demographics (gender, age), time aspects (time from first symptom to first medical contact, time from the first medical contact to a correct diagnose), symptoms (facial pain, toothache, foul odour, foul taste, nasal discharge, cold, facial and nasal congestion, loss of smell and taste, cough and intermittent fever) and clinical findings (tooth percussion-induced pain, maxillary sinus percussion-induced pain, toothache, pus in the nasal cavity or oropharynx, swollen nasal mucosa, rhinitis, nasal polyposis) were

extracted manually and evaluated by both an ENT specialist (KT) and a dentist/specialist in maxillofacial radiology (MVF). Follow-up (time from the first medical appointment to our last review of the medical records) was approximately five years. The patients were not scheduled for a new visit, but the medical records were reviewed for 5 years regarding new episodes of sinusitis.

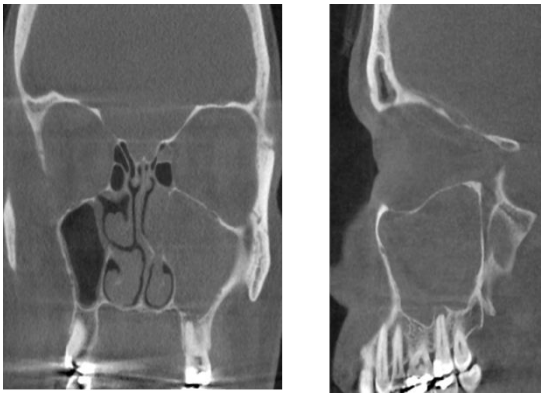

Figure 2b: CBCT examination showing an MSDO on the left side. Periapical destruction of tooth 27 with communication and spread of infection into the left maxillary sinus. The tissue surrounding the teeth, including the trabecular bone, is well defined and easily assessed.

In 10 patients, it was not possible to identify the time from the first symptoms to the first medical contact or similar measures; consequently, these patients were excluded (Figure 1). The mean age of the MSDO group was 56 years (range 36-81), and mean age of the URTI group was 46 years (range 17-87). See Figure 1 for demographic data.

The medical records of the patients with no signs of dental pathology on CBCT were evaluated specifically for symptoms or findings that occurred after CBCT, indicating that the sinusitis might have had a dental origin after all. The sensitivity and specificity of CBCT to detect dental pathology in patients with maxillary sinusitis could then be determined.

Permission to read patient records was obtained from the director of each department, and patient data from the medical records were de-identified and compiled into a database.

Statistics

IBM SPSS Statistics for Windows, Version 22.0 (released 2013; Armonk, NY: IBM Corp) was used for the descriptive statistical analysis. The OpenEpi program was used to calculate standard chi-square tests. A p-value < 0.05 was considered statistically significant.

Results

Symptoms

The overall prevalence of symptoms reported in the medical records for the two groups of patients is presented in Table 1.

Facial pain was reported by 83% of the patients with URTI sinusitis and 52% of the patients with MSDO sinusitis (p=0.011). None of the patients with unilateral URTI sinusitis reported bilateral facial pain. Unilateral facial pain was reported by 90% of the patients with unilateral URTI sinusitis and 44% of the patients with MSDO (p=0.016).

Symptoms	URTI unilateral n=10	URTI bilateral n=26	URTI total n=36	p-value	MSDO unilateral n=25
Unilateral facial pain	9 (90%)	0 (0%)	9 (25%)	0.1349	11 (44%)
Bilateral facial pain	0 (0%)	21 (81%)	21 (58%)	0.0001*	2 (8%)
Toothache	0 (0%)	1 (4%)	1 (3%)	0.0408*	5 (20%)
Foul odour	1 (10%)	5 (19%)	6 (17%)	0.0001*	18 (72%)
Foul taste	2 (20%)	4(15%)	6(17%)	0.0018*	14 (56%)
Unilateral nasal discharge	5 (50%)	3 (12%)	8 (22%)	0.0599	19 (76%)
Bilateral nasal discharge	0 (0%)	15 (58%)	15 (42%)	0.2377	2 (8%)
Cold	4 (40%)	24 (88%)	28 (75%)	0.0001*	8 (32%)
Facial congestion	6 (60%)	23 (88%)	29 (81%)	0.0227*	13 (52%)
Nasal congestion	4 (40%)	18 (65%)	22 (58%)	0.1157	10 (40%)
Loss of smell	1 (10%)	4 (15%)	5 (14%)	0.0634	0 (0%)
Loss of taste	1 (10%)	0 (0%)	1 (3%)	0.5902	0 (0%)
Cough	0 (0%)	14 (54%)	14 (39%)	0.0070*	2 (8%)
Intermittent fever	2 (20%)	12 (46%)	14 (39%)	0.1286	5 (20%)

*=p-value<0.05

Table 1: The p-value was calculated by comparing the total number of URTIs (TOT URTI) and the number of MSDOs.

Toothache was reported by five patients (20%) with MSDO and one patient (3%) with URTI. Foul odour and foul taste were reported more often by patients with MSDO (72% and 56%, respectively) than by patients with URTI sinusitis (17% for both symptoms) (p<0.002). A total of 64% of the patients with URTI sinusitis reported nasal discharge, compared to 84% of the MSDO patients (p=0.094).

Signs of viral infection, such as common cold, intermittent fever, nasal congestion and cough, were more prevalent in the patients with sinusitis of URTI origin; 75% of the URTI patients, compared to 32% of the MSDO patients, reported symptoms of the common cold (p=0.001).

Facial congestion was commonly reported by patients with bilateral URTI (88%), while 60% of the patients with unilateral URTI and 52% of the patients with MSDO reported this symptom (p=0.005 for bilateral URTI compared with MSDO and p=0.023 for URTI total compared with MSDO).

Finally, loss of smell or taste was not a prominent symptom in these patients. Loss of smell was reported by 14% of patients with URTI sinusitis and none of the patients with MSDO.

Clinical findings

Table 2 summarizes the clinical findings in the sinusitis patients.

Clinical findings	URTI unilateral n=10	URTI bilateral n=26	URTI total n=36	p-value	MSDO unilateral n=25
Tooth percussion induced pain	1 (10%)	0 (0%)	1 (3%)	0.0944	4 (16%)
Maxillary sinus percussion induced pain	6 (60%)	17 (65%)	23 (64%)	0.0026*	6 (24%)
Pus observed in nasal cavity or in the oropharynx	4 (40%)	16 (62%)	20 (56%)	0.7905	13 (52%)
Swollen nasal mucosa	2 (20%)	13 (50%)	15 (42%)	0.1665	6 (24%)
Rhinitis	1 (10%)	9 (35%)	10 (28%)	0.0625	2 (8%)
Nasal polyposis	2 (20%)	1 (4%)	3 (8%)	0.9819	2 (8%)
*=p-value<0.05					

Table 2: The p-value was calculated by comparing the total number of URTIs and MSDOs.

In four patients with MSDO (16%) and one patient with URTI sinusitis (3%), tooth percussion-induced pain (=tapping the tooth with an instrument) was reported in the medical record, while maxillary sinus percussion-induced pain (=tapping over the maxillary sinuses with a finger) was a common finding in the patients with URTI sinusitis (64%, compared to 24% of the MSDO patients; p=0.003).

Pus was observed in the nasal cavity or oropharynx in 56% of the URTI patients compared to 52% of the MSDO patients. Swollen nasal mucous membranes and rhinitis where slightly more prevalent in the patients with URTI sinusitis (42% and 28%, respectively) than in those with MSDO (24% and 8%, respectively).

Time intervals

Time between first symptom and first medical contact: All 19 of the patients who had a doctor's appointment within 2 weeks of symptom debut, could be found within the URTI group.

Within the group of patients who had a doctor´s appointment 3-7 weeks after symptom debut, 2/3 (n=13) of the patients had an URTI sinusitis and 1/3 (n=7) had a MSDO. The patients who waited for 2 months or longer before seeking health care were predominately from the group of MSDO patients (URTI n=4; MSDO n=18) (Figure 3).

Time from first medical contact to correct diagnose also differed significantly between the URTI and MSDO group (Figure 4).

Among the patients who got the correct diagnose within a week from first seeking healthcare 27 of 31 had a URTI sinusitis. 10(40%) of the 25 patients with MSDO had to wait 2 months or longer before getting the correct diagnose, to be compared with only 1(3%) of 36 in the group of URTI sinusitis (p=0.003).

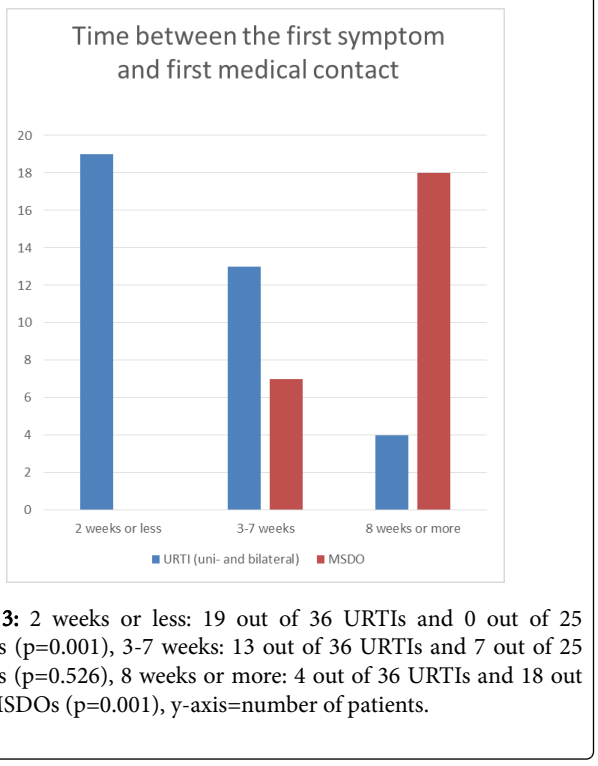

Figure 3: 2 weeks or less: 19 out of 36 URTIs and 0 out of 25 MSDOs (p=0.001), 3-7 weeks: 13 out of 36 URTIs and 7 out of 25 MSDOs (p=0.526), 8 weeks or more: 4 out of 36 URTIs and 18 out of 25 MSDOs (p=0.001), y-axis=number of patients.

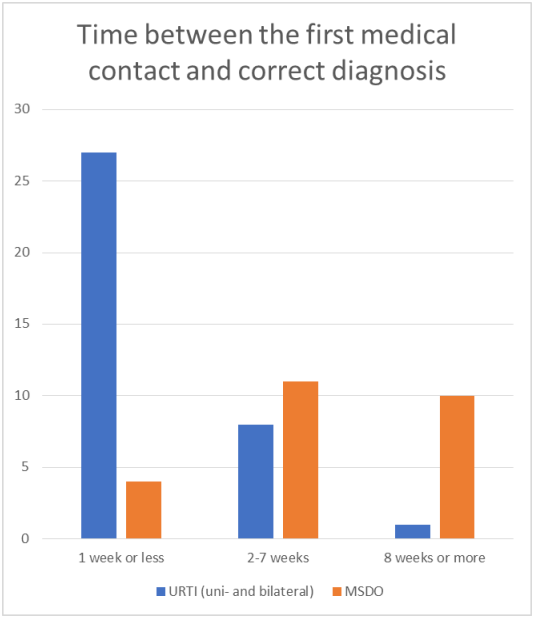

Figure 4: 1 week or less: 27 out of 36 URTIs and 4 out of 25 MSDOs (p=0.001), 2-7 weeks: 8 out of 36 URTIs and 11 out of 25 MSDOs (p=0.083), 8 weeks or more: 1 out of 36 URTIs and 10 out of 25 MSDOs (p=0.003), y-axis=number of patients.

Accuracy of CBCT

The accuracy of CBCT to detect dental pathology as the underlying cause of sinusitis was 97% with a sensitivity and specificity of 92% and 100% respectively see (Table 3).

	MSDO	URTI
Test+(for MSDO on CBCT)	23 (TP)	0 (FP)
Test-(for MSDO on CBCT)	2 (FN)	36 (TN)

Table 3: True positive (TP); true negative (TN); false positive (FP); false negative (FN) maxillary sinusitis of dental origin (MSDO); cone beam computed tomography (CBCT); accuracy of CBCT for detecting MSDO=97%; sensitivity=92%; specificity=100%.

Discussion

In the present study we found more symptoms related to foul odour and smell in patients with MSDO and less symptoms of common cold, compared to patients with URTI sinusitis. Especially the symptoms of foul odour and smell could be helpful clues for clinicians to suspect a MSDO, since these patients often had been in contact with the health care for long periods, in some cases more than a year, before the correct diagnosis was made. The delay from first symptoms to the first visit to the health care among the MSDO patients could also suggest that the symptoms were of lower intensity than compared to URTI sinusitis.

Compared to earlier studies, our study reports some slight differences in clinical findings; Pokorny et al. [11] reviewed the records of 33 patients with MSDO, also retrospectively. In their report, 90% of their patients complained of sinus (facial) pain; in comparison, our study found that only 52% of the MSDO patients but 83% of the patients with URTI sinusitis complained of this symptom.

Additionally, 42% of their patients also complained of toothache, while only 20% of the MSDO patients in our study reported this symptom. A toothache is caused either by increased intrapulpal pressure (pulpitis due to caries or a fracture) or inflammation of the surrounding supportive tissues (periodontitis). When a dental infection spreads from the pulp into surrounding tissue, the intrapulpal pressure is relieved, which leads to less pain or referred pain [13]. Therefore, the MSDO patients could have had toothache prior to the sinusitis without necessarily mentioning it during the clinical examination.

Furthermore, 65% of the patients in the study by Pokorny et al. [11] complained of drainage, which is less than the 84% of the MSDO patients in our study who complained of uni and bilateral nasal discharge. Forty-eight percent of the patients in the Pokorny et al. study complained of congestion (nasal), similar to 40% of the MSDO patients in our study.

Longhini et al. [14] reviewed 21 patients with CT-confirmed dental sinusitis and found that 48% complained of a rotten smell or bad taste; in contrast, foul odour and foul taste were prevalent in 72% and 56% (18/25 foul odour and 14/25 foul taste) of the patients with MSDO in our study, respectively. In the Longhini et al. study, dental pain was prevalent in 29% of patients, which is quite similar to the 20% identified in our study.

Ly et al. reported a prevalence of foul odour or taste in 44% of the MSDO group [5], which was somewhat less than in our present study; however, this symptom was clearly significant in both our study and the study by Ly et al.

Regarding the accuracy of CBCT for detecting MSDO, only two patients were initially diagnosed with URTI sinusitis and later verified as having MSDO. The accuracy could therefore be calculated as 97% (Table 3). The sensitivity and specificity were also high at 92% and 100% respectively. The value of CBCT for detecting MSDO was therefore verified [15]. CBCT is a valuable tool for diagnosing a dental genesis of maxillary sinusitis arising from the teeth in the upper jaw, but the results should be evaluated in consideration of the clinical findings and the patient's medical history.

Some of the patients with MSDO had been in contact with health care for months (in some cases more than a year) before they eventually received the correct diagnosis, which underlines the need for health care providers to act when patients report symptoms such as a foul odour or smell. Surprisingly, not many of the MSDO patients reported tooth percussion-induced pain; however, this may be due to the use of inappropriate percussion techniques by non-dentists. Therefore, we still believe that tooth percussion can and should be used to diagnose pulpitis, although a negative result should not always be equated with non-inflamed/healthy pulp.

Our study suggests that patients with MSDO report unilateral purulent nasal discharge, foul odour and foul taste more often than patients with URTI. Patients who complain of long-lasting sinusitis that does not improve or improves only temporarily with the administration of antibiotics should also raise the suspicion of MSDO. These patients should be evaluated with computed tomography, preferably CBCT, which in our study proved to be a valuable tool for diagnosing MSDO.

Conclusion

In conclusion, suspicion of MSDO should be raised in patients with sinusitis that does not heal and presents little pain, unilateral symptoms, and a foul odour or foul taste.

These patients should be referred to radiology to rule out an underlying odontogenic cause. CBCT is easy to perform and has diagnostic advantages over MSCT when imaging the dental periapical region. CBCT is therefore a reliable tool for detection of maxillary sinusitis of dental origin and should be used if available.

Methodological Considerations/Limitations

One weakness of this study is the retrospective design, which created a risk of selection bias as some patients with sinusitis did not undergo radiology. Ten cases also had to be excluded due to incomplete medical records.

Ethical Approval

The study was approved by the regional ethics committee of Umeå University, dnr: 2014-326-32M.

Acknowledgements

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References

1. Bender IB (2000) Pulpal pain diagnosis-a review. J endod 26: 175-179.
2. Bomeli SR, Branstetter BF, Ferguson BJ (2009) Frequency of a dental source for acute maxillary sinusitis. Laryngoscope 119: 580-584.
3. Ferguson M (2014) Rhinosinusitis in oral medicine and dentistry. Aust Dent J 59: 289-295.
4. Lechien JR, Filleul O, Costa de Araujo P, Hsieh JW, Chantrain G, et al. (2014) Chronic maxillary rhinosinusitis of dental origin: A systematic review of 674 patient cases. Int J Otolaryngol 2014: 465173.
5. Legert KG, Zimmerman M, Stierna P (2004) Sinusitis of odontogenic origin: Pathophysiological implications of early treatment. Acta Otolaryngol 124: 655-663.
6. Lofthag-Hansen S, Thilander-Klang A, Grondahl K (2011) Evaluation of subjective image quality in relation to diagnostic task for cone beam computed tomography with different fields of view. Eur J Radiol 80: 483-488.
7. Longhini AB, Ferguson BJ (2011) Clinical aspects of odontogenic maxillary sinusitis: A case series. Int Forum Allergy Rhinol 1: 409-415.
8. Ly D, Hellgren J (2018) Is dental evaluation considered in unilateral maxillary sinusitis?: A retrospective case series. Acta Odontol Scand 76: 600-604.
9. Matsumoto Y, Ikeda T, Yokoi H, Kohno N (2015) Association between odontogenic infections and unilateral sinus opacification. Auris Nasus Larynx 42: 288-293.
10. Mehra P, Jeong D (2009) Maxillary sinusitis of odontogenic origin. Curr Allergy Asthma Rep 9: 238-243.
11. Melen I, Lindahl L, Andreasson L, Rundcrantz H (1986) Chronic maxillary sinusitis: Definition, diagnosis and relation to dental infections and nasal polyposis. Acta Otolaryngol 101: 320-327.
12. Pokorny A, Tataryn R (2013) Clinical and radiologic findings in a case series of maxillary sinusitis of dental origin. Int Forum Allergy Rhinol 3: 973-979.
13. Shahbazian M, Jacobs R (2012) Diagnostic value of 2D and 3D imaging in odontogenic maxillary sinusitis: A review of literature. J Oral Rehabil 39: 294-300.
14. Suomalainen A, Vehmas T, Kortesniemi M, Robinson S, Peltola J (2008) Accuracy of linear measurements using dental cone beam and conventional multislice computed tomography. Dentomaxillofac Radiol 37: 10-17.
15. Vestin Fredriksson M, Ohman A, Flygare L, Tano K (2017) When Maxillary sinusitis does not heal: Findings on CBCT scans of the sinuses with a particular focus on the occurrence of odontogenic causes of maxillary sinusitis. Laryngoscope Investig Otolaryngol 2: 442-446.