

Cone Beam Computed Tomography in an Evaluation and Diagnosis of Anatomical Variations and Pathological Lesions in Maxillary Sinus Prior to Maxillary Sinus Lift Surgery

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Abstract: Thorough assessment of the maxillary sinus is very important. Recently 3-dimensional image with Cone Beam Computed Tomography (CBCT) is very dependable in Maxillary Sinus diagnosis. The aim of this study is to: shade light on the role of (CBCT) diagnosis of the maxillary sinus anatomical variation and pathological finding among smokers and nonsmokers prior to maxillary sinus lift techniques.

Materials and Method: In this study 60 males with age ranged between 20-50 years old, referred for (CBCT) assessment of maxillary sinus in the Specialist Health Center of Al-Sadder city. The scanning were performed using Kodak 9500 (CBCT), the KV was 90, mA10 and scanning time 10 s. Voxel size 0.3mm with (DICOM) software on a multiplaner reconstruction window in which the axial, coronal and sagittal plane could be visualized in 0.3 mm interval, 40 were smokers and 20 nonsmokers, both sides were evaluated to assess the presence of septa, maxillary sinus membrane (Schneiderian membrane) thickening, complete opacification and adenoid polyp.

Result: The maxillary for nonsmoker patients (20) patients were clean and have no any pathological or anatomical changes, among smoker patients, it was found that 7 (17.5%) of them had a clean maxillary sinus, 25 (62.5%) patient from smokers, the mucosal thickening was clear and measured more than 4 mm, 20 (80%) of them bilateral maxillary sinus were involved and 5 (20%) of them have a unilateral thickening, 6 (15%) of the smoker patient have bilateral involved adenoid with max sinus, and 2(5%) of them have full opacification., no septa was found in this study.

Conclusion: Cone Beam Computed Tomography (CBCT) was the most useful technique to diagnose maxillary sinus before maxillary sinus augmentation, an evaluation of Cone Beam Computed Tomography (CBCT) scans before implant surgery or sinus augmentation procedures has extreme clinical importance in evaluation of anatomic structures, such as thickening of the Schneiderian membrane and presence of pathological lesion such as adenoid polyp.

Key words: Cone beam computed tomography, maxillary sinus, anatomical variations. (J Bagh Coll Dentistry 2016; 28(1):99-102).

INTRODUCTION

Sound knowledge of maxillary sinus and its anatomical variations is very important for surgeons, especially before surgical procedures, such as insertion of dental implants with or without maxillary sinus lifting ⁽¹⁻³⁾. Anatomic variations within the sinus, such as septa and mucosal thickening of the sinus floor increase the possibility of the sinus membrane perforation during pre-implant surgery in maxillary sinus ⁽⁴⁾.

Very few knowledge about the thickening and the dimension of the maxillary sinus membrane, there is no specific method for evaluation and classification of mucosal findings in it. Many findings determined that, the thickening of maxillary sinus mucosa less than 2 mm was considered as a normal variant ^(5,6).

Radiographically, the normal maxillary sinus, because it is air filled so it is radiolucent structure, while its walls appear as radiopaque ⁽⁷⁾. In the case of a diseased sinus, a radiologist may observe clouding (opacifying) or mucosal thickening ⁽⁸⁾.

Thorough assessment of the maxillary sinus is very important. Panoramic imaging technique is used widely in dentistry but it is still 2-dimensional image that loss some important anatomical details recently, (CBCT) is considered as an acceptable alternative. Since the end of 90s (CBCT) has become a popular imaging technique in dentistry, even for visualization of the paranasal sinuses ^(9,10).

(CBCT) can accurately capture, display and provide undistorted 3-dimensional view of maxillofacial anatomy and pathology. It is important to be acquainted with different anatomic and pathologic findings in maxillary sinus, (CBCT) scanning has become the standard in dentistry for evaluating the maxillary sinuses because of the ability to accurately scanning the sinus in multiple views with thin sectioning ⁽¹¹⁾. (CBCT) images allow localizing the anatomic structures and providing information about bone dimensions and morphology ^(12,13). The relationship between smoking and thickening of sinus mucosa was direct relationship ⁽¹⁷⁾.

The effect of smoking and non-allergic inhalants cause chronic inflammation of the nasal and sinus mucosa which may lead to adenoid polyp formation ⁽¹⁸⁾.

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The present study was designed to:

- 1- Shed light on the importance of (CBCT) in pre implant evaluation for patients who have alveolar bone loss in the maxillary sinus area.
- 2- To compare the maxillary sinus appearance and pathological images between smokers and nonsmokers.

MATERIALS AND METHODS

In the present study 60 males with age ranged between 20-50 years old, (mean 35 years) referred to (CBCT) scanning for maxillary sinus in Specialist Health Center in AL-Sadder City. The scanning were performed using Kodak 9500 (CBCT), French origin, the Kv was 90, mA10 and time of scan 10 s. Voxel size 0.3mm with (DICOM) software on a multiplaner reconstruction window in which the axial, coronal and sagittal plane could be visualized from period between September 2014 to march 2015.

CBCT scan was done for all patients to assess the presence of any anatomical variation or pathological finding pre implant associated with maxillary sinus augmentation. Scanning of maxillary sinus was performed by using three orthogonal slices. The (CBCT) scans were analyzed by independent two readings by the specialist radiologist. The criteria of evaluation based on scanning of: (1) presence of septa, (2) mucosal thickening more than 2mm, (mucosa was measured from different point corresponding to the underlying bone in the area of 1st, 2nd premolars and 1st, 2nd molars, the highest point was recorded), (3) full opacification of maxillary sinus and/or any other (4) pathological finding. Classification of mucosal thickening (14).

- (1) Flat: shallow thickening without well-defined (irregular) outlines.
- (2) Semi-spherical: thickening with well defined (round) outline
- (3) Mucocele-like: complete opacification of the sinus.

All patients were asked about: Age, tobacco use, classified as with duration of more than 2 years, history of sinusitis and time of last extraction. All patients were informed about the aim and method of the study and they fill a special consent form after their agreement in participation.

Chi square statistical analysis was used to compare the result finding between smokers and nonsmokers.



(A)



(B)

Figure 1: (A&B) Coronal View Showing Bilateral Thickening of Maxillary Sinus Membrane.



Figure 2: Coronal view Showing Unilateral Thickening of Maxillary Sinus Membrane



(A)



(B)

Figure 3: (A) Axial & (B) Coronal Showing Full Opacification of the Lt. Maxillary Sinus



(B)
Figure 4: (A) Axial and (B) Coronal View Represent Bilateral Maxillary Sinus Adenoid Polyp

RESULTS

The (CBCT) scanning of 60 patients were included in the sample, 40 of them were smokers and 20 nonsmokers.

As shown in the table 1, maxillary sinus for nonsmoker patients were totally clear and have no pathological or anatomical changes (mucosal

thickening and full opacification), while among smoker patients it was found that, 7 (17.5%) from 40 smoker patient were showed a clear maxillary sinus, and 25 (62.5%) from 40 patient associated with maxillary sinus mucosal thickening which measured more than 4 mm as shown fig1, from those 25 patients 20 (80%) of them bilateral maxillary sinus were involved as clear in fig1, and 5 (20%) of the unilateral thickening of maxillary sinus as clear in figure 2.

Two patients(5%) of smoker patients have full opacification which was seen only among smoker patients fig 3, 6 patients (15%) among smoker patients have a pathology of maxillary sinus(bilateral involved) which is adenoid polyp, as shown in figure 4.

The difference between two groups was highly significant since the anatomical changes and pathological findings were found only among smokers group.

Table 1: Clear the Percentage of the Thickening, Adenoid and Full Opacification in Respect to the Side among Two Study Groups.

| Criteria | Smokers No. (%) | Non-smokers No. (%) | Groups' difference | | | |
|--------------------|-----------------|---------------------|--------------------|------------------|------|------------|
| | | | X ² | Likelihood ratio | d.f. | p-value |
| Presence of septa | 0 | 0 | 0 | 0 | 0 | 0 |
| Clear | 7 (17.5%) | 20 (100%) | 36.667 | 45.479 | 3 | 0.000 (HS) |
| Thickening | 25 (62.5%) | 0 (0%) | | | | |
| Bilateral | 20 (80%) * | 0 (0%) | | | | |
| Unilateral | 5 (20%) * | 0 (0%) | | | | |
| Adenoid Bilateral | 6 (15%) | 0 (0%) | | | | |
| Full opacification | 2 (5%) | 0 (0%) | | | | |
| Total | 40 (100%) | 20 (100%) | | | | |

***Percentages were calculated from 25 cases**

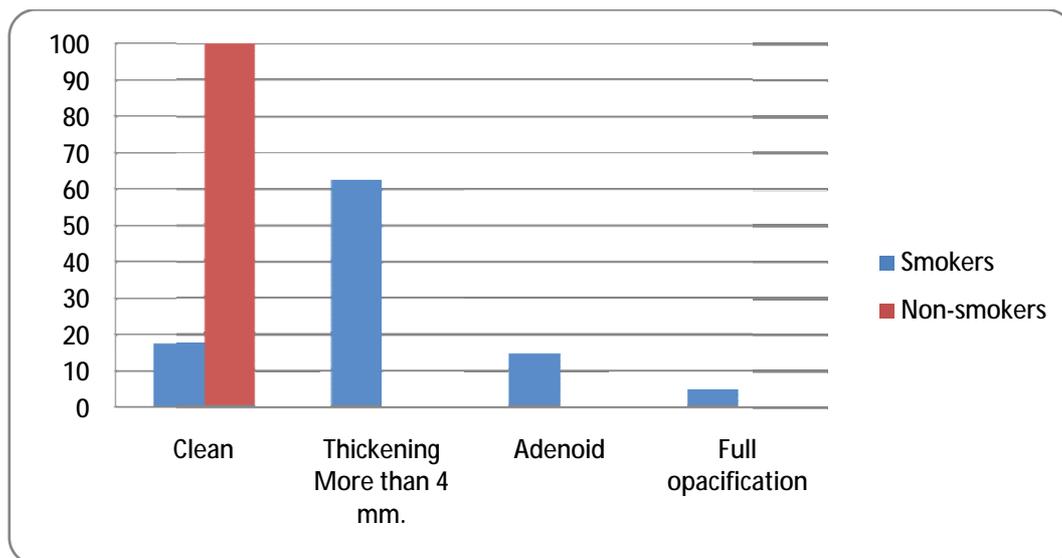


Figure 4: The Percentages of the Thickening, Adenoid and Full Opacification for Both Groups.

DISCUSSION

In the present study after the evaluation of maxillary sinus it was found that the thickening of sinus membrane has the highest percentage among the other changes (62%), while the full opacification was found in only 2 patients (5%), this is in conformity with Ilze et al.,⁽¹⁵⁾ who found that, there was thickening in 19 patients from 33 patients, 14 bilateral and 5 unilateral, slight difference of the percentage between two studies may be due to sample size differences and also conform with Rega et al.,⁽¹⁶⁾ who stated that, the most prominent anatomical changes was thickening of maxillary sinus membrane followed by full opacification.

It is clear that there is a direct relationship between smoking and thickening of sinus mucosa which is in agreement with Janner et al.,⁽¹⁷⁾.

In this study, it was found that 6 patients involved with adenoid polyp and all of them were bilateral, since the smoker effect on the sinuses as its effect on lung epithelial, especially these adenoids were found only among smoker patients and this disagrees with Ilze et al.,⁽¹⁵⁾ who found no pathological findings among his sample.

While Gorgulu et al.,⁽¹⁸⁾ result is very near to the present results, they approved that, smoking is found to be the only risk factor for development of maxillary sinus and nasal polyp, and they concluded that the smoking restriction and avoiding exposure to cigarette smoking by patient with nasal polyps may be important in prevention of the recurrence of nasal and sinus polyp.

According to the result of the present study, one can consider CBCT as an accurate diagnostic tool to evaluate the anatomical changes pathological disease in maxillary sinus and significant effects of smoking on maxillary sinus.

REFERENCES

- 1- Chan HL, Wang HL. Sinus Pathology and Anatomy in Relation to Complications in Lateral Window Sinus Augmentation. *Implant Dent* 2011; 20:1-7.
- 2- Naitoh M, Suenaga Y, Kondo S, Gotoh K, Arijji E. Assessment of Maxillary Sinus Septa Using Cone-Beam Computed Tomography: Etiological Consideration. *Clinical Implant Dentistry and Related Research* 2009; 11: 52-8.
- 3- Özyuvaci H, Aktas I, Yeri K, Aydin K, Firatli E. Radiological Evaluation of Sinus Lift Operation: What

- the General Radiologist Needs to Know. *Dentomaxillofac Radiology* 2005;34: 199-204.
- 4- Neugebauer J, Ritter L, Mischkowski RA, Dreiseidler T, Scherer P, Ketterle M. Evaluation of Maxillary Sinus Anatomy by Cone-Beam CT Prior to Sinus Floor Elevation. *Int J Oral Maxillofac Implants* 2010;5:258-5.
- 5- Rak KM, Newell JD, Yakes WF, Damiano MA, Luethke JM. Paranasal Sinuses on MR Images of the Brain: Significance of Mucosal Thickening. *AJR Am J Roentgenol* 1991; 156:381-4.
- 6- Thunhy KH. Diseases of the Maxillary Sinus. *Gen Dent* 1998; 46:160-5
- 7- Maloney PL, Doku HC. Maxillary Sinusitis of Odontogenic Origin. *J Can Dent Assoc (Tor)* 1968;34:591-603.
- 8- Poyton HG. Maxillary Sinuses and the Oral Radiologist. *Dent Radiogr Photogr* 1972; 45:43-50.
- 9- Ziegler CM, Woertche R, Brie J, Hassfeld S. Clinical Indications for Digital Volume Tomography in Oral and Maxillofacial Surgery. *Dentomaxillofac Radiol* 2002;31:126-30.
- 10- Bremke M, Sesterhenn AM, Murthum T, Hail AA, Kadah BA, Bien S, Werner JA. 2008
- 11- Nishimura T, Iizuka T. Evaluation of Odontogenic Maxillary Sinusitis after Conservative Therapy Using CT and Bone SPECT. *Clin Imaging* 2002;26:153-60
- 12- Beaumont C, Zafiropoulos GG, Rohmann K, Tatakis DN. Prevalence of Maxillary Sinus Disease and Abnormalities in Patients Scheduled for Sinus Lift Procedures. *J Periodontol* 2005;76:461-7.
- 13- Guerro ME, Jacobs R, Loubele, Schutyser F, Suetens P, Van Steenberghe D. State of the Art on Cone Beam CT Imaging for Preoperative Planning of Implant Placement. *Clin Oral Investig* 2006;10:1-7.
- 14- Soikkonen K, Ainamo A. Radiographic Maxillary Sinus Findings in the Elderly. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1995;80: 487-91.
- 15- Ilze D, Ligija K, Peteris A, Gints K, Andris B. Radiographic Assessment of Findings in the Maxillary Sinus Using Cone-Beam Computed Tomography. *Stomatologija Baltic Dental and Maxillofac J* 2013; 15:4.
- 16- Rega I, Susa Th, Leles C, Mendonca E. Accuracy of Maxillary Sinus Abnormalities Detected by Cone Beam CT in Asymptomatic Patient. *BMC Oral Health* 2012; 12:30
- 17- Janner SFM, Caversaccio MD, Dubach P, Sendi P, Buser D, Bornstein MM. Characteristics and dimensions of the Schneiderian Membrane: a Radiographic Analysis Using Cone Beam Computed Tomography in Patients Referred for Dental Implant Surgery in the Posterior Maxilla. *Clin Oral Impl* 2011;
- 18- Gorgulu O, Ozdmir S, Canbolat EP, Sayar C, Olgun MK, Akbas Y. Analysis of the Roles of Smoking and Allergy in Nasal Polyposis. *Ann Otol Rhinol Laryngol* 2012; 121(9):615-9.