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Odontogenic Maxillary Cysts Post-Dental Implant: Proposal of New Radiological/Clinical Classification

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Abstract:-

The purpose of this study was to expose a new classification odontogenic maxillary cysts post-dental implant and asses functional surgical treatment with fewer complication, which not only insured normal maxillary sinus cilia restoration and bony integrity but also did little damage to maxillary sinus natural ostium. The maxillofacial region is affected by a greater number of cysts. Chronic maxillary sinusitis of dental origin (CMSDO) is a common disease that requires treatment of the sinusitis as well as of the odontogenic source. In this study odontogenic maxillary cysts post-dental implant were classified from 42 patients over a five-year period. Odontogenic cysts are the most common form of the cystic lesions that affect the maxillofacial region. They are classified traditionally into a developmental group, including keratocysts and dentigerous cysts, and an inflammatory group including radicular cysts. Different clinical situations were included in the study, they have been classified as odontogenic maxillary cysts post-dental implantation and integrated into a new classification system based on the pathogenesis and clinical aspects of each case, with the aim of identifying homogenous treatment groups. Results were evaluated for each class. Objectives are review the spectrum of odontogenic diseases affecting the maxillary sinus, their radiographic appearances e their treatment. Review the various radiologic examinations of both the maxillary sinus and adjacent dental structures. The purpose of this paper is the anatomical relationship between the dental region and the maxillary antrum. The widespread use of reconstructive procedure for dental implants placement has improved to type's complication. To the author's knowledge, no publication has extensively examined sinonasal complication as odontogenic maxillary cysts resulting from dental implants fixture and no classification system.

Keywords: *- **Odontogenic sinusitis, rhinosinusitis, Functional Endoscopic Sinus Surgery (FESS), dental implants, Schneiderian membrane.***

Introduction

Although the high predictability and long-term success rate of dental implants is well documented in the literature, complications and failures can occur. Proportional to the increase in the volume of dental implants being placed is the number of adverse events that will occur. Some complications may be relatively minor and easy to correct, while others will be major and result in the loss of the implant or prosthesis1,2. Implant complications and failures are most likely to occur within the first year of placement of the dental implant fixture and delivery of the final prosthesis, with some studies suggesting complete implant failure ranging from 3% to 8%. After an implant has been restored and placed in function for the first year, failure rates are dramatically reduced and have been reported 3 to be around 1%3-4. The treatment of odontogenic maxillary sinus disease is directed to management of the sinusitis and the odontogenic source5. Approximately 5–15 % of the population suffers from chronic rhino sinusitis and in 10–12 % of them, it is of dental origin6. Chronic maxillary sinusitis of dental origin may be caused by chronic oroantral fistula, foreign bodies (teeth roots, dental fillings or endodontic materials, parts of broken instruments, implants) pushed into the maxillary sinus, odontogenic cysts occupying partly or totally the maxillary sinus, or inflammatory cysts from the premolar and molar teeth7. The maxillary antrum and dental region share a close anatomical relationship which means that dental infections and other odontogenic disease can affect the maxillary sinus. There is variability in the literature of reported maxillary sinus mucosal hyperplasia of odontogenic origin, ranging from 58% to 78% and greater variability regarding the frequency of dentaly induced maxillary sinusitis, ranging from 4,6% to 47%. Determining the primary site of disease in these cases can be a diagnostic dilemma from both clinical and radiographic standpoint8,9. Radiographic examinations such as conventional intraoral periapical radiography,dental panoramic radiography, standard plain films of the paranasal sinus. CT and MRI can be useful in evaluating sinus disease of odontogenic origin10. Some common dental pathologies

that can affected the maxillary antra such as periapical cysts, follicolar cysts, odontomas, keratocystic odontogenic tumors, dental implants, oroantral fistulas will be discussed, and their imaging finding reviewed11-12. Different clinical situations were included in the study, they have been classified as odontogenic maxillary cysts post-dental implantation and integrated into a new classification system based on the pathogenesis, clinical aspects and imaging finding of each case, with the aim of identifying homogenous treatment groups. Results were evaluated for each class.

Patients and Methods

A total of 42 patients, 23 males and 19 females, with a mean age of 56,4 years and the mean follow-up period was 9,1 months, were retrospectively studied. Each patient underwent chart and imaging review by computed tomography (CT) scan showing dental pathology, analyze demographic factors, diagnostic criteria, clinical course, and management. Overall patients were included in the study, they have been classified as odontogenic maxillary cysts post-dental implantation and integrated into a new classification system based on the pathogenesis and clinical aspects of each case, with the aim of identifying homogenous treatment groups. Results were evaluated for each class: 10 (23,8 %) of these patients were diagnosed odontogenic cysts dental on implants protrude into the maxillary sinus (Class I); 8 (19 %) patients presented odontogenic cysts occupying partly the maxillary sinus with cortical lining and dental implants protrude into the maxillary sinus (Class II); Of these, 7 (16,6 %) patients had maxillary sinus infection secondary to peri-implantitis, resolved with concurrent FESS and dental surgery (class III); 17 (40,4 %) patients with odontogenic odontogenic sinusitis post-dental implants occupying totally the maxillary sinus (10 males and 7 females), submitted to Functional Endoscopic Sinus Surgery (FESS). The procedure were performed by the same surgeon (firs author), so the outcomes can be considered comparable. Overall patients had disease resolution and unilateral odontogenic sinusitis. The follow-up protocol is followed after surgery has been placed in a four-stage approach. The patient is seen two days after treatment for packing remove, after one week for a postsurgical instructions, and observation of healing. Careful attention is given to the possibility of soft tissue, hard tissue, and/or sinusitis reinfection. The patient is seen six weeks post-FESS with the expectation that lateral nasal wall healing should be complete. At this time, nasal hygiene is reviewed and a maintenance appointment is scheduled. The patient is scheduled three months post-surgery for a maintenance appointment. A classification (Radiologic/Clinic Staging System sec. Gamba) for odontogenic maxillary cysts post-dental implant encountered during a fixture placement procedure is presented. Four of the class are discussed, as are the therapeutic options for their repair. Class I and Class II perforations are most easily repaired, while Class III, and Class IV, FESS performed. In addition, the effect of the sinus membrane perforation on the course of proposed therapy is discussed. This paper provides a system of classification that can be used by clinicians to collect data on odontogenic maxillary cysts post-dental implants and surgery results.

Class I: Coronal CT image shows the implants in place with bone support other than the sinus wall and mucosal thickening around the implant. 64-year-old male with a periapical cyst found around the dental implants placement (Fig. 1).

Class II: 76-year-old female with an implants fixture placement on coronal CT images. CT image shows a large well-circumscribes lesion surrounded by a soft mass occupies partly right maxillary sinus (Fig. 2).

Class III: dental implants complication in a 74-year-old male with pain and inadequate healing. This can result if implants penetrate into the maxillary sinus. Preoperative imaging can evaluate the dimension of the alveolar process, in order to determine the need for a alveolar ridge augmentation or sinus lift with bone grafting (Fig. 3).

Class IV: maxillary sinusitis due to a displaced root in a 61-year-old male with implants. The more common causes of maxillary sinusitis related to dentistry include perforation of the sinus membrane the sinus during fixture placement and extrusion of materials into the sinus during root canal therapy (Fig. 4).

Coronal CT images shows the displaced root within the alveolar part of the maxillary sinus and associated sinus mucosal tickening.

(Table-1) Radiologic/Clinic Staging System sec. Gamba. The algorithm proposed for the choise of optimal intervention implies the use of FESS only when maxillary cysts occupying totally the maxillary sinus (Class IV). In selected cases the surgery treatment of odontogenic maxillary cysts is directed to management of the sinusitis and the odontogenic source with evidence periapical radiolucency (Class III). In according to literature, perforation is the most common complication during maxillary cavity surgery13. To repair small perforation (5-10 mm), a collagen membrane is recommended large perforations (>10 mm) should be blocked with a cross-linked type I collagen membrane to prevent potential complication14-15. The risk of infection after maxillary sinus during implant placement or bone filling is small in the presence of normal bacteria flora16. With meticulously performed surgery in healthy individuals, the perforation of

the maxillary sinus membrane has a low probability of resulting in maxillary sinusitis. However, large perforations and the consequent loss of bone graft materials through the maxillary sinusitis. Small perforations that occur during implant placement often heal spontaneously17-18. In addition to the size of the perforation, the length of the implant inside the sinus cavity is also important. The exposure of implants inside the nasal cavity can induce rhino sinusitis; an implant exposed in the nasal cavity can alter flow within the nasal cavity and induce inflammation of the nasal cavity mucosa19. An important exposed in the maxillary cavity may similarly change the function of the maxillary cavity. To determine whether the deposition of foreign materials increases with time and whether increased deposition within the maxillary cavity causes inflammation, long-term studies are required. We observed that when the implant exposed in the maxillary cavity was not covered by the maxillary sinus membrane; foreign material was deposited on the exposed implant surface. This is thought to induce acute and chronic maxillary sinusitis20-21.

Discussion

The cilia on the inner surface of the maxillary sinus serve to remove bacteria and foreign through the maxillary sinus ostium. Furthermore, the anatomical location of the maxillary sinus ostium can render drainage difficult and increase the risk the infection. Even after the completion of growth, penumatization of the maxillary sinus progresses continuously. In dentate individuals, the continued pneumatization and expansion can occur such that online the sinus mucoperiosteum (Schneidarian membrane) is left22. In edentulous individuals, continued expansion may leave only the alveolar bone between the sinus and oral cavity (ad a result, patients may need and alveolar ridge augmentation priori to dental implants. The lateral wall of the maxilla is more easily penetrated than the sinus floor. As a result, otontogenic infections commonly present with soft tissue vestibular/facial infections and sinusitis. Intraoral periapical radiography: can help evaluate for a dental connection in maxillary sinus disease. Limited by lack of three-dimensional information and incomplete visualization of the maxillary sinus. Panoramic radiography: can help estabilish the anatomic relationship between the dental structures and maxillary sinus. Limited spatial resolution23. However, the dentoalveolar and inferior areas of the maxillary sinus overlap. Computed tomography: high spatial resolution helps delineate bony and soft tissue Abnormalities and are best done in the coronal plane. MRI superior soft tissue definition. Compact bone and teeth yield poor signal24. Radiographic examination of the maxillary sinus and adjacent dental structures revealed three types: a roots of a tooth, and if dental implants protrude into the maxillary sinus; the second type: dental periapical abscess chronic apical revealed rounded lucency, three condition: maxillary sinusitis due to a displaced, other cause include perforation of the sinus membrane during tooth extraction25. The maxillary sinus becomes more closely associated with the teeth and consequently is more readily injured by odontogenic infection, surgical procedure and trauma. Thus the importance of the maxillary sinus has been emphasized in oral surgery. In our study, the radiologic examination of maxillary sinusitis was evaluated in terms of the thickening of the maxillary sinus membrane and mucosa26-27. Consequently, mucosal thickening was prevalent. However, it has been reported that the pattern of liquidation is difficult to detect radiologically 28,29,30. Endoscopy should be considered not only for intraoperative observation and assessment of implant sites, but also should be applied for active assistance during implant placement procedures. Endoscopy is a procedure that can be used to improve the visualization of surgical sites with difficult access. The treatment of odontogenic maxillary sinus disease is directed to management of the sinusitis and the odontogenic source. Chronic maxillary sinusitis of dental origin may be caused by chronic oroantral fistula, foreign bodies (teeth roots) dental fillings or endodontic materials, parts of broken instruments, implants) pushed into the maxillary sinus, odontogenic cysts occupying partly or totally the maxillary sinus, or inflammatory cysts from the premolar and molar teeth 31-32. As a conclusion, endoscopic assistance in surgical treatment of odontogenic sinus disease expands the effectiveness of conventional surgery and reduces the complications arising from an aggressive procedure. In case were endoscopic approach alone was not adequate to visualize the extent of the disease and proceed to treatment Caldwell-Luc approach33.

Conclusions

When treating maxillary sinusitis, it is important to consider the disease history, including symtoms, causative factors, and history of surgery, togheter with the radiological findings and histological examination. Odontogenic sinusitis is a well-recognized, but understudied form of sinusitis34. Odontogenic sinusitis requires unique diagnostic criteria and a treatment regimen that differs from non-odontogenic sinusitis. The purpose of this article is to present a new classification and standardized treatment protocols in patients with odontogenic sinusitis. Endoscopic diagnostic examinations in conjunction with modern imaging methods, particularly computed tomograph (CT), have proved to be an ideal combination on recent years and are already accepted as the “Standard of Cure” for sinus disease35. The FESS demonstrates extremely few complications and a low morbidity rate. Endoscopic transnasal surgery for the odontogenic maxillary cyst is less invasive than conventional dental approach, and most of the affected teeth can be preserved. This technique appears to be a simple and highly effective surgical treatment for the treatment of

patients with odontogenic cysts that extend to the maxillary sinus. Management of odontogenic sinusitis needs to be tailored to each individual patient and involves varying combinations of medical management, dental surgery, and ENT surgeon36. To the author's knowledge, no publication has extensively examined sinonasal complication as odontogenic maxillary cysts resulting from dental implants fixture and no classification system.

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Table 1. Radiologic/Clinic Staging System sec. Gamba

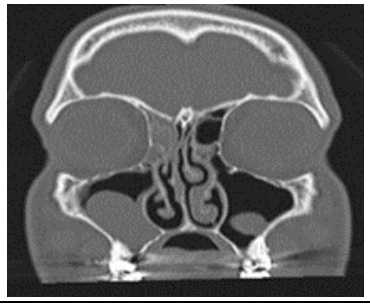
Odontogenic Maxillary Cysts Post-Dental Implant: classification and standardized treatment protocols (sec. Gamba)				
Class	**N° Patients (42 Tot)**	**CT**	**Imaging**	**Treatment**
I	**10 pts** (23%)	Male, 64 ys, asymptomatic. Odontogenic cysts occupying partly the maxillary sinus. Dental implants protrude into the maxillary sinus. Bone levels should be stable with no evidence of peri-implant platform or periapical radiolucency. *Maxillary sinus mucosal hyperplasia:* ***< 1/3***		None
II	**8 pts** (19%)	Female, 76 ys, asymptomatic. Odontogenic cysts occupying partly the maxillary sinus. Bone levels should be stable with no evidence of peri-implant platform or periapical radiolucency. *Maxillary sinus mucosal hyperplasia:* ***>1/3 or < 2/3***		None
III	**7 pts** (16,6%)	Male, 74 ys, right nasal obstruction. Odontogenic cysts occupying partly the maxillary sinus. Dental periapical abscess chronic apical revealed rounded lucency. *Maxillary sinus mucosal hyperplasia:* ***> 2/3***		**FESS** (selected cases) **+Dental Surgery**
IV	**17 pts** (40,4%)	Male, 61 ys, right nasal obstruction, cacosmia, pain in the left zygoma area with headache in the left temporal region.. Odontogenic maxillary sinusitis due to a perforation of the sinus membrane during dental implant displacement. *Maxillary sinus mucosal hyperplasia:* ***3/3***		**FESS+Dental Surgery** (selected cases)
FESS: Functional **E**ndoscopic **S**inus **S**urgery.				

Fig 1: Coronal CT image shows the implants in place with bone support other than the sinus wall and mucosal thickening around the implant. 64-year-old male with a periapical cyst found around the dental implants placement.

Fig 2: 76-year-old female with an implants fixture placement on coronal CT images. CT image shows a large well-circumscribes lesion surrounded by a soft mass occupies partly right maxillary sinus.

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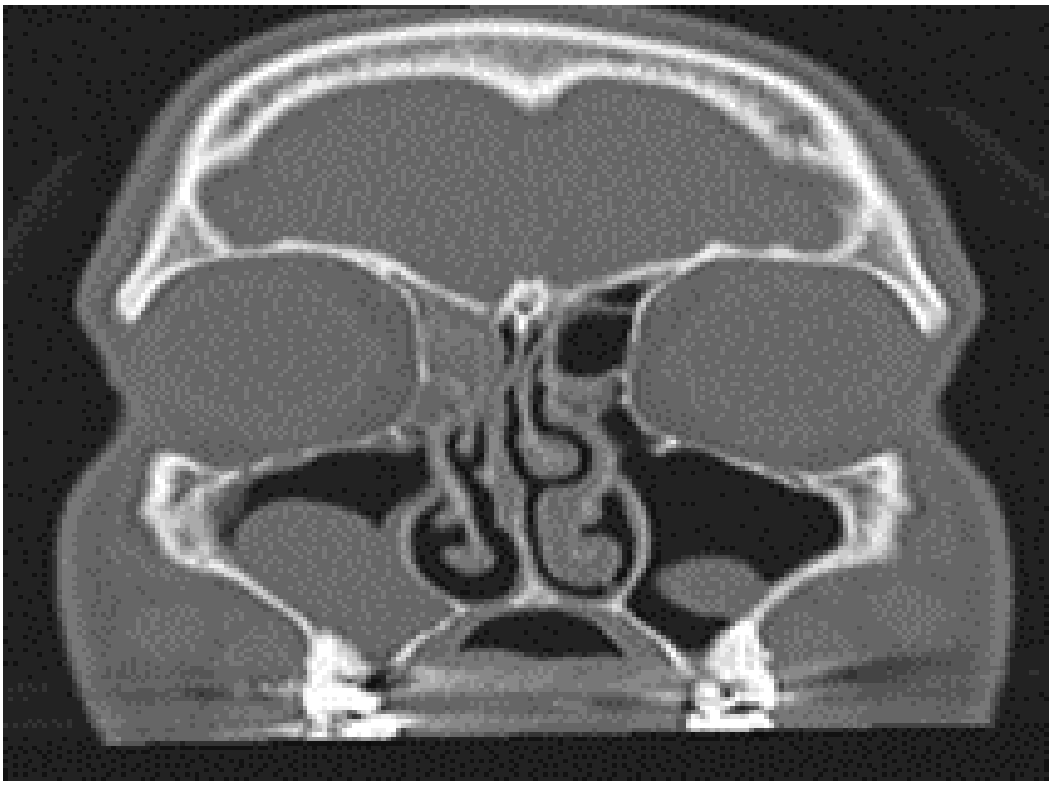

Fig 3: dental implants complication in a 74-year-old male with pain and inadequate healing. This can result if implants penetrate into the maxillary sinus. Preoperative imaging can evaluate the dimension of the alveolar process, in order to determine the need for a alveolar ridge augmentation or sinus lift with bone grafting.

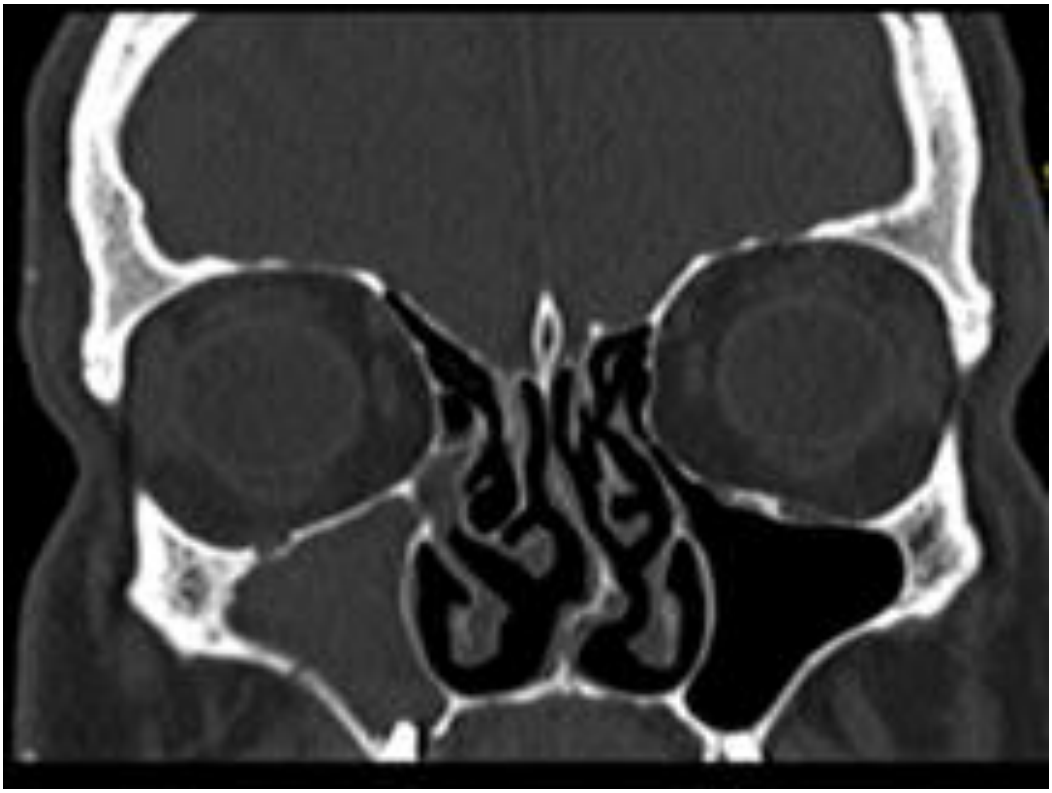

Fig 4: maxillary sinusitis due to a displaced root in a 61-year-old male with implants. The more common causes of maxillary sinusitis related to dentistry include perforation of the sinus membrane the sinus during fixture placement and extrusion of materials into the sinus during root canal therapy. Coronal CT images shows the displaced root within the alveolar part of the maxillary sinus and associated sinus mucosal tickening.