

**Survey of recommended referral patterns for
incidental maxillary sinus and airway findings on
CBCT analysis in an orthodontic population**

A THESIS

SUBMITTED TO THE FACULTY OF THE GRADUATE SCHOOL
OF THE UNIVERSITY OF MINNESOTA

BY

Sara Audrey Gaalaas

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF MASTER OF SCIENCE

Advisor: Brent E. Larson, DDS, MS

July 2017

Acknowledgements

I would like to extend a great thank you to Dr. Lars Gaalaas and Dr. Holly Boyer. This project would not have been possible without your guidance and insight, and it has been a real pleasure working with you.

I thank Dr. Larson, Dr. Grünheid, and Dr. Beyer for your expertise and critical feedback. I have learned much from you during this project as well as in my clinical training.

To Dr. Eric Smith, thank you for all the advice and editing help you have given. To Lei Zhang, thank you for your statistical support.

Thank you to the entire University of Minnesota Division of Orthodontics for your support throughout this residency.

Last but certainly not least, I thank my parents and Will. I could not have accomplished so much without your support and encouragement, and I am so looking forward to our journey ahead.

Abstract

Introduction: Cone beam computed tomography (CBCT) is an increasingly more common form of radiography, and dental professionals are obligated to manage all incidental findings identified on scans. Clarification of standards for management of CBCT findings would help the practitioner, especially for findings of the airway and sinuses.

Aims: The primary aim was to evaluate recommendations of otolaryngologists to dentists for follow up of sinus and airway findings identified on CBCT analysis. The secondary aim was to report on prevalence of maxillary sinus and airway findings on CBCT analysis in an orthodontic population.

Methods: A survey with CBCT images of 22 sinus and airway findings was submitted to otolaryngologists (n = 269) for review, and de-identified CBCT reports of orthodontic patients were reviewed to evaluate the prevalence of sinus and airway findings. Frequencies were calculated for responses and findings.

Results: Thirty-six otolaryngologists participated in the survey. The most commonly recommended actions were to 1) immediately refer the patient to an otolaryngologist, and 2) ask additional questions regarding sinonasal symptoms before referring. In the orthodontic population studied, a total of 53.8% patients had maxillary sinus or airway findings listed on CBCT scan reports. The most commonly reported finding was mucosal thickening.

Conclusions: Incidental maxillary sinus and airway findings are commonly found on CBCT scans. When such findings are identified on CBCT analysis, otolaryngologists generally recommend evaluating the patient for symptoms, and referring the patient to an otolaryngologist for follow up. For findings that are variants of normal, the recommendation is to not refer the patient for follow up unless they are positive for sinonasal symptoms. For findings that demonstrate inflammatory conditions, the recommendation is to refer the patient for follow up, especially if they have sinonasal symptoms. For findings with changes in the bony wall of the sinuses, the recommendation is to immediately refer the patient to the otolaryngologist for follow up. Consultation with an oral and maxillofacial radiologist or otolaryngologist is recommended to best manage incidental sinus and airway findings present on CBCT scans.

Table of Contents

Introduction	1
Review of Literature	4
Study Aims	11
Materials and Methods	12
Results	19
Discussion	27
Conclusions	40
References	41
Appendices	45

List of Figures

Figure 1.	Example of survey question.	13
Figure 2.	Survey case recommendations by otolaryngologists.	22
Figure 3.	Prevalence of incidental maxillary sinus and airway findings on CBCT analysis in 2014.	26
Figure 4.	Incidental maxillary sinus and airway findings grouped by referral recommendations.	35

List of Tables

Table I.	List of maxillary sinus and airway cases evaluated in survey.	14
Table II.	Background data on survey respondents.	19
Table III.	<i>P</i> -values of associations between case response frequencies and years in practice or location of training.	24
Table IV.	List of maxillary sinus and airway cases evaluated in survey, and linked incidental findings identified on CBCT reports.	38

Introduction

In the field of dentistry the use of cone beam computed tomography (CBCT) is quickly gaining popularity for the assessment and diagnosis of craniofacial structures. Stemming from its ability to reconstruct dimensionally accurate three-dimensional (3-D) craniofacial structures, multiple advantages exist with the use of CBCT over traditional (two-dimensional, 2-D) radiographic imaging. In addition to visualizing the area of interest, CBCT examination of the craniofacial region also reveals non-dentoalveolar findings – termed incidental findings because of their non-primary or ‘surprise’ nature.

Incidental findings found on CBCT analysis are often located in the airway area, with rates as high as 18.2% to 51.8% of total incidental findings (Cha *et al*, 2007; Pliska *et al*, 2011; Cagayan and Tozoglu, 2012; Price *et al*, 2012; Edwards *et al*, 2014). Specifically, many studies report mucosal thickening of the maxillary sinus as being the most frequent incidental sinus pathology noted (Ritter *et al*, 2011; Gracco *et al*, 2012; Lana *et al*, 2012; Rege *et al*, 2012; Dobele *et al*, 2013; Raghav *et al*, 2014; Vogiatzi *et al*, 2014). Other sinus and airway findings commonly reported include maxillary sinus opacification, polypoid mucosal thickening, mucous retention cysts, air-fluid levels, antrolith/foreign bodies, and sinus hypoplasia (Ritter *et al*, 2011; Gracco *et al*, 2012; Lana *et al*, 2012; Rege *et al*, 2012; Dobele *et al*, 2013; Raghav *et al*, 2014).

A limitation of CBCT, however, is its limited ability to differentiate various fluid or soft tissue findings, which can make certain maxillary sinus and airway

diagnoses indistinguishable. For example, findings such as mucous retention cysts, polyps, and mucoceles would all appear similar due to their bulbous soft tissue or fluid-filled nature. While dental professionals are well trained in identifying and managing pathologies of the oral cavity, findings outside of the oral cavity often require referral to another specialist for definitive diagnosis and treatment. Importantly, all providers ordering CBCT scans have an ethical and legal responsibility to diagnose, treat, or refer all findings seen on radiological scans, even if the findings are beyond the oral cavity (Zinman *et al*, 2010; Miles and Danforth, 2014).

Though there is an abundance of literature on the frequency of incidental maxillary sinus and airway findings, the clinical significance – in terms of needing follow up or referral – has not been fully addressed (Ritter *et al*, 2011; Gracco *et al*, 2012; Lana *et al*, 2012; Rege *et al*, 2012; Dobeles *et al*, 2013; Raghav *et al*, 2014; Vogiatzi *et al*, 2014). Notably, studies that have examined the clinical significance of incidental findings found on CBCTs all categorize their findings based on assessments made by oral and maxillofacial radiologists (OMFRs) (Pliska *et al*, 2011; Price *et al*, 2012; Drage *et al*, 2013; Dođramıcı *et al*, 2014). While this has relevance, it may be more appropriate to consult a managing specialist of the particular finding to determine whether referral is needed. In other words, consultation with an otolaryngologist regarding the need for follow up on paranasal sinus and airway findings may yield more clinically meaningful results, particularly because soft tissue lesions are often difficult to distinguish on

CBCT analysis.

The purpose of this study was to evaluate recommended referral patterns of otolaryngologists to dentists regarding incidental maxillary sinus and airway findings on CBCT analysis. An additional goal was to evaluate the prevalence of maxillary sinus and airway findings on CBCT analysis in an orthodontic population in order to compare and validate the present study population against those on which have already been reported. By reporting on recommendations provided by the specialists who may ultimately manage the CBCT findings, namely otolaryngologists, the results can further clarify the standards for management of CBCT incidental maxillary sinus and airway findings.

Review of Literature

Use of CBCT in Dentistry

CBCT provides an accurate 3-D representation of hard and soft tissues at a relatively low cost and low radiation dosage (White and Pharoah, 2008; Farman and Scarfe, 2009; Tetradis and White, 2010). Although it imparts a higher effective dose than conventional 2-D radiographs often used in dentistry, such as panoramic and lateral cephalometric radiographs, the effective dose of CBCT is generally much lower than multidetector CT (MDCT) (Li, 2013). Depending on CBCT instrument settings, such as the field of view (FOV), voxel size, or scan time, the effective dose ranges from 84 μ Sv to 212 μ Sv (Ludlow *et al*, 2015), while the effective dose of MDCT can be 5- to 20-fold (Li, 2013). The benefit of 3-D imaging and relatively low burden to the patient and practitioner make CBCT a valuable tool in dentistry.

Commonly reported uses of CBCT in dentistry include diagnosing and treatment planning orthognathic surgery, orthodontics, and implant or miniscrew placement; visualization of impacted or supernumerary teeth; evaluation of dentoalveolar and maxillofacial trauma; identification of bone pathologies; and assessment of periodontal bone levels, periapical disease, and root resorption. Other reported uses include evaluation of the TMJs, foreign bodies, and cleft lip/palate. (White and Pharoah, 2008; De Vos *et al*, 2009; Ahmad and Freymiller, 2010; Tetradis and White, 2010; Kapila *et al*, 2011) With such a variety of dental applications, the clinician must ensure there is an appropriate diagnostic need for

CBCT imaging in addition to a careful review of all findings in the scan.

Dentistry and Structures Beyond the Oral Cavity

Craniofacial structures beyond the oral cavity, such as paranasal sinuses and airway structures, may be affected by dentoalveolar conditions and treatment. For example, there is evidence showing an association between the occurrence of mucosal thickening and the presence of periapical lesions or periodontal disease (Brüllman *et al*, 2012; Lu *et al*, 2012; Phothikun *et al*, 2012; Shanbhag *et al*, 2013; Eggman *et al*, 2016; Nascimento *et al*, 2016). Authors suggest that dental pathology “can cause maxillary sinus inflammation as well as oroantral fistulas, conditions that are in the focus of dental medicine and should be diagnosed in CBCT when present” (Ritter *et al*, 2011). Knowing the status of the maxillary sinuses is important for dental implant planning, endodontic therapy, and to rule out a sinus etiology for orofacial pain (Ahmad and Freymiller, 2010). In addition, the prudent orthodontist must acknowledge the changes that occur in the airway during rapid maxillary expansion and orthognathic surgery (Buck *et al*, 2016a; Buck *et al*, 2016b; Christovam *et al*, 2016; Rosario *et al*, 2016).

Incidental Maxillary Sinus and Airway Findings on CBCT

The prevalence of incidental maxillary sinus and airway findings has been well studied, with a reported frequency ranging from 14.3% to 82% (Ritter *et al*,

2011; Gracco *et al*, 2012; Lana *et al*, 2012; Rege *et al*, 2012; Dobele *et al*, 2013; Raghav *et al*, 2014; Vogiatzi *et al*, 2014). As previously mentioned, incidental CBCT findings were often located in the airway (Cha *et al*, 2007; Pliska *et al*, 2011; Cagayan and Tozoglu, 2012; Price *et al*, 2012; Edwards *et al*, 2014), and the most frequent incidental sinus pathology noted on CBCT was mucosal thickening of the maxillary sinus (Ritter *et al*, 2011; Gracco *et al*, 2012; Lana *et al*, 2012; Rege *et al*, 2012; Dobele *et al*, 2013; Raghav *et al*, 2014; Vogiatzi *et al*, 2014). The prevalence of maxillary sinus pathology has been reported to be higher in men than in women (Ritter *et al*, 2011; Gracco *et al*, 2012; Rege *et al*, 2012; Vogiatzi *et al*, 2014), and some report an increased prevalence in older populations (Ritter *et al*, 2011; Gracco *et al*, 2012). Dental professionals ordering CBCT scans will likely encounter incidental findings of the airway and sinuses. Thus, it is critical for them to build their knowledge of identifying and managing such incidental findings.

While many studies have investigated the prevalence of incidental airway and sinus findings, few have reported on their clinical significance. According to the literature, follow up has been recommended only for a minority (6.8% to 26.4%) of incidental sinus and airway findings found on CBCT analysis (Pliska *et al*, 2011; Price *et al*, 2012; Drage *et al*, 2013; Dođramıcı *et al*, 2014). Findings that warranted follow up included antroliths, calcification in sinus wall, fluid filled sinus, soft tissue filled sinus, opacified sinus, oroantral fistula, and pansinusitis. Findings that did not require follow up included concha bullosa, deviated nasal

septum, nasal septum with spur, hypoplastic sinus, and pneumatized sinus.

There were, however, findings that had inconsistent recommendations – some studies advised follow up while others did not. These findings included mucous retention pseudocyst, polyps, sinusitis, and thickened mucosal lining.

Additionally, in each of the studies an OMFR determined the clinical significance of incidental findings. (Pliska *et al*, 2011; Price *et al*, 2012; Drage *et al*, 2013; Dođramıcı *et al*, 2014). The management of incidental CBCT sinus and airway findings would benefit from further investigation. Consulting otolaryngologists may provide needed clarification as they are often the specialists who ultimately treat these findings.

Identification of Incidental Findings by Dental Professionals

As CBCT may be used for the diagnosis and treatment planning of orthodontic care, a number of studies have looked at the diagnosis of incidental findings on CBCT scans in orthodontic patients. Results overall indicate non-optimal diagnosis and management of incidental findings by orthodontists. One study recently found that there was “excellent” intrarater agreement and only “fair-to-good” interrater agreement between orthodontists assessing the need for follow-up and the clinical impact of incidental findings on CBCT analysis (Edwards *et al*, 2015). Subsequently, the authors acknowledged that there is no standard of agreement in terms of the level of interpretation or management of identified findings (Edwards *et al*, 2015).

Another study evaluated the ability of orthodontists and orthodontic residents to identify non-orthodontic incidental findings on CBCT scans (Ahmed *et al*, 2012). It was found that both groups of evaluators had high error rates for missed lesions and false positives before and after training, relative to published error rates for medical radiology (Ahmed *et al*, 2012). The authors recommended involving trained radiologists when interpreting CBCT scans to minimize the chance of missing lesion identification and subsequent malpractice litigation (Ahmed *et al*, 2012), particularly OMFRs who have specific training on radiographic findings in the craniofacial region and a knowledge of dentistry.

An additional study tested the accuracy and reliability of orthodontists to classify adenoid hypertrophy using CBCT (Pacheco-Pereira *et al*, 2016b). While interoperator reliability was excellent, the orthodontists' accuracy was poor leading to the conclusion that "orthodontists make consistent and systematic errors in th[ese] types of evaluations" (Pacheco-Pereira *et al*, 2016b). In a separate study, the same authors tested the accuracy and reliability of OMFRs to screen for adenoid hypertrophy on CBCT exam (Pacheco-Pereira *et al*, 2016a). Unlike the orthodontists tested, both the reliability and accuracy of OMFRs was good (Pacheco-Pereira *et al*, 2016a). Clearly, orthodontists and, perhaps, other dental professionals must improve their ability to diagnose and manage CBCT incidental findings, especially when there is no OMFR involved to evaluate the scan.

Use of Surveys in Health Research

In dental and medical research, surveys and questionnaires provide a method of gathering important, cost-effective information on clinicians' knowledge, attitudes, and practice patterns (Leece *et al*, 2004; VanGeest *et al*, 2007; Shelley *et al*, 2012; Cunningham *et al*, 2015). However, surveying physicians generally yields low survey response rates (Leece *et al*, 2004; VanGeest *et al*, 2007; Shelley *et al*, 2012; Cunningham *et al*, 2015). Thus, there are several studies reporting on factors associated with response rates and methodologies to improve response rates (Parsons *et al*, 1994; Kellerman and Herold, 2001; Nakash *et al*, 2006; VanGeest *et al*, 2007; Cunningham *et al*, 2015). Some examples of strategies to increase response rate are keeping the questionnaires brief, offering a small financial incentive, displaying endorsements from legitimate associations, and providing paid postage for mailed surveys (Kellerman and Herold, 2001; VanGeest *et al*, 2007).

While response rates often influence the validity of surveys, there are other factors that can affect the bias and quality of survey results. These include methodological errors involving measurement, coverage, and sampling. Specifically, measurement error involves the reliability and accuracy of a respondent's answer, and whether the wording, design, or mode of the survey affects the way the respondent answers. Coverage error may occur when the sample group does not reflect the survey population. This may be due to inaccurate or duplicate sample information, or due to not including all members

of the population. Sampling error often involves nonrandom sampling of the population, but can also occur if a sample size calculation was not done in the event the total population was not surveyed. Furthermore, respondents completing a particularly long survey or multiple surveys in a short period of time may experience questionnaire fatigue. (Shelley *et al*, 2012)

Knowing the potential for biased survey results, there are strategies that can be employed to improve the survey quality. In order to test survey design, question wording, and mode of distribution, a pilot group of subjects may be surveyed. This allows for feedback and modifications to be made prior to distributing the survey to the sample group. Also, a test-retest of the survey may allow for examination of respondent reliability. Careful data collection on the survey population and random selection of the sample group aids in minimizing both coverage and sampling error. Lastly, designing brief surveys may reduce questionnaire fatigue as well as increase response rates, as mentioned previously. (Shelley *et al*, 2012)

A well designed survey allows for examining the recommendations of otolaryngologists regarding the management of various CBCT incidental maxillary sinus and airway findings. This can provide clarification for dental professionals when faced with identifying and managing incidental findings on their CBCT analysis.


Study Aims

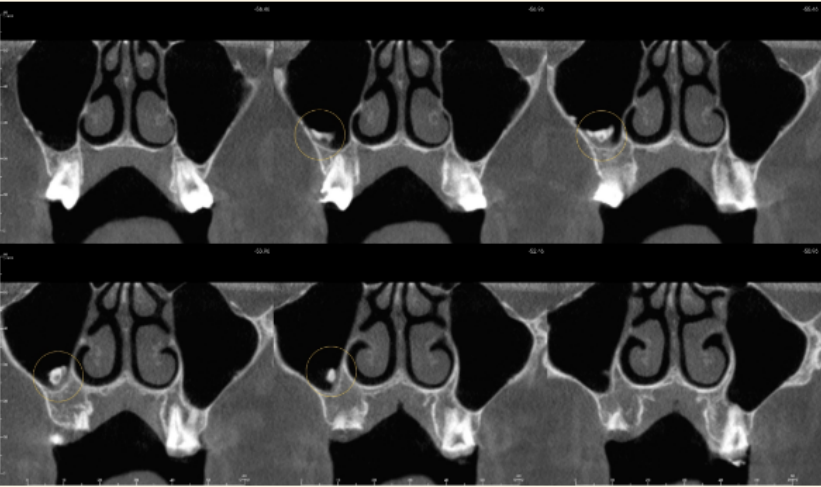

The primary aim of this was study to evaluate the recommendations of otolaryngologists to dental professionals regarding referral of various incidental maxillary sinus and airway findings as found on CBCT analysis. A secondary aim was to assess the prevalence of incidental maxillary sinus and airway findings on CBCT analysis in an orthodontic patient population.

Materials and Methods

This descriptive study was comprised of two components, both of which received approval by the University of Minnesota Institutional Review Board (Study Number 1511P80661). The primary aim included a survey with CBCT images of 22 abnormal maxillary sinus and airway findings. The CBCT images were compiled primarily from the second component to this study, with supplemental OMFR teaching files. For each finding, de-identified and standardized axial and coronal images were formatted with InVivoDental software (Anatomage Inc, San Jose, CA). Crosshairs and circles were added to each image to highlight the region of interest. Images were imported into Qualtrics (Qualtrics, LLC, Provo, UT), an online survey platform, to prepare the survey. An example of a survey question is shown in Figure 1, and a list of findings used in the survey is shown in Table I. The cases were randomly ordered in the survey, and there were no labels visible to the survey participant indicating the finding name of each case.

Figure 1. Example of survey question.

 UNIVERSITY OF MINNESOTA
Driven to Discover™



Based on the representation of this finding, would you recommend the dentist to:

- Do nothing - inform patient of the finding, but there is no need for workup or referral
- Ask additional questions regarding sinonasal symptoms, and refer to primary care provider/physician or otolaryngologist only if positive for symptoms
- Immediately refer to primary care provider/physician
- Immediately refer to otolaryngologist

Comments:

Table I. List of maxillary sinus and airway cases evaluated in survey.

Adenoid hypertrophy	Heterogeneous opacification of maxillary sinus #2
Air-fluid level #1	Large mucocele/cystic lesion ^a
Air-fluid level #2	Mucosal thickening of sinus floor
Antrolith/foreign body	Palatine tonsil hypertrophy
Blocked ostiomeatal unit	Polypoid mucosal thickening
Bone erosion of sinus wall	Septal deviation/septal spur
Concha bullosa	Septal perforation
Disrupted sinus wall	Sinus hypoplasia
Ethmoid sinusitis	Sinus opacification with bone erosion
Fibrous dysplasia	Sinus osteomyelitis
Heterogeneous opacification of maxillary sinus #1	Small mucocele/cystic lesion ^a

^a For the purposes of this study, large and small mucoceles/cystic lesions may represent sinus mucoceles, mucous retention cysts, or other cystic lesions.

The survey was submitted to a group of trained and certified otolaryngologists for review. Potential subjects were accessed through the Minnesota Academy of Otolaryngologists (MAO), which includes otolaryngologists who practice in the Midwest region, primarily in the state of Minnesota. This population was selected to evaluate regional trends and for its accessibility. The subjects were contacted by email with a link to a customized survey hosted by Qualtrics. The subjects were able to complete the survey anonymously on their personal computer or mobile device. No time restriction was imposed, and the subjects were able to intermit, save, and return to the survey if they chose not to complete it in one session. The survey was available for eight weeks. Two reminder emails were sent to the subjects, and a reminder announcement was made at the MAO Annual Midwinter Conference held in Minneapolis, MN.

Following a brief introduction to the survey, a consent information form was presented as a downloadable and printable PDF file, and the subjects were asked to confirm their consent. The subjects were unable to proceed without confirming consent to participate in the study.

Survey questions were designed to gather data on recommended referral protocols and the otolaryngologist's background (years in clinical practice, location of otolaryngology training, and focus/subspecialty of practice). A pilot survey was submitted to a group of eight otolaryngologists in order to test the survey format, question and image quality, and time needed to complete the

survey.

The primary outcome variable for this part of the study was, “What is the otolaryngologist’s recommended action?” For each of the 22 sinus and airway findings the survey participant was asked, “Based on the representation of this finding, would you recommend the dentist to...,” with response selections including:

- 1) Do nothing – inform the patient of the finding, but there is no need for workup or referral
- 2) Ask additional questions regarding sinonasal symptoms, and refer to primary care provider/physician or otolaryngologist only if positive for symptoms
- 3) Immediately refer to primary care provider/physician
- 4) Immediately refer to otolaryngologist

For each case question the respondent could select only one response. There was an optional comments box provided for use. Response frequencies were calculated for each survey question.

For aim two, a review of de-identified radiology reports of orthodontic patients was conducted to assess the prevalence of abnormal maxillary sinus and airway findings. These patients received CBCT scans as part of their care at the University of Minnesota. All CBCT scans were read by one of two board certified OMFRs who created a written report for each scan. Radiology reports for the year 2014 were accessed and cross-referenced with the subject’s orthodontic chart to confirm consent granted for use of their records for research

purposes. Exclusionary criteria, including a history of craniofacial malformation or cleft lip and/or palate, was also identified. In the event that a subject had more than one radiology report in the year 2014, the earliest report in 2014 was used. Inclusionary criteria for these subjects were: having a positive report of incidental maxillary sinus or airway finding on CBCT analysis, regardless of whether symptoms were reported, and being between the ages of 5 and 65 years.

The CBCT instrument used for all scans was a Next Generation i-CAT (Imaging Sciences International, LLC, Hatfield, PA) with machine settings of 120 kVp, 37.10 mA, 0.3mm enhanced resolution voxel, 23 cm x 17 cm field of view, and 17.8 second scan acquisition time.

Statistical Analysis

Microsoft Excel (Microsoft Corp, Redmond, WA) was used to calculate survey response frequencies for each question, as well as to calculate frequencies of various incidental findings on CBCT reports.

Fisher's exact test was used to evaluate the association between each case question and years of practice or location of training, and a p -value of less than or equal to 0.05 was considered significant. The years of practice categories were condensed into three groups (0–5y, 6–20y, \geq 20y) to reduce the complexity and number of tests to run against all 22 cases. These groups were chosen to evaluate for response differences between clinicians in the early, middle, or late stages of their career. The training locations categories were condensed into two groups (Midwest and Other), again, to reduce the complexity and number of tests to run against 22 cases. These groups were chosen to evaluate the practice philosophy taught in the Midwest in comparison to other locations.

Results

The survey was sent to 269 otolaryngologists. Thirty (11.1%) subjects completed the survey, and an additional six (2.2%) partially completed it. The most commonly reported location of training was the Midwest (73.7%), with the most common time in clinical practice at 16–20 years (29.0%), and the most common focus of practice as general otolaryngology (79.0%) (Table II).

Table II. Background data on survey respondents.

Years in Clinical Practice		Otolaryngology Focus/Subspecialties	
0-5	10.5%	Audiology	0.0%
6-10	23.7%	Broncho-esophagology	2.6%
11-15	5.3%	Endocrine surgery	7.9%
16-20	29.0%	Facial plastic & reconstructive surgery	13.2%
21-25	7.9%	General otolaryngology ^a	79.0%
26-30	7.9%	Head & neck surgery	21.1%
≥30	15.8%	Laryngology	5.3%
		Maxillofacial surgery	2.6%
		Neurotology	0.0%
Location of Training		Otolaryngic allergy	5.3%
West	5.3%	Otolaryngic pathology	0.0%
Midwest	73.7%	Otology	21.1%
Northeast	10.5%	Pediatric otolaryngology	13.2%
South	5.3%	Rhinology	31.6%
Other than U.S. (Canada and Brazil)	5.3%	Skull base surgery	5.3%
		Sleep medicine	5.3%
		Other	0.0%

^a Although not technically a 'subspecialty', general otolaryngology was included in the list from which survey participants could choose in the event they had no subspecialty.

Referral recommendations are shown in Figure 2. The majority of respondents (>70%) recommended taking no action or asking about symptoms prior to referring for follow up for the following findings:

- Small mucocele/cystic lesion
- Concha bullosa
- Septal deviation/septal spur
- Sinus hypoplasia
- Disrupted sinus wall
- Antrolith/foreign body

In contrast, the majority of respondents (>70%) recommended immediate referral for the following findings:

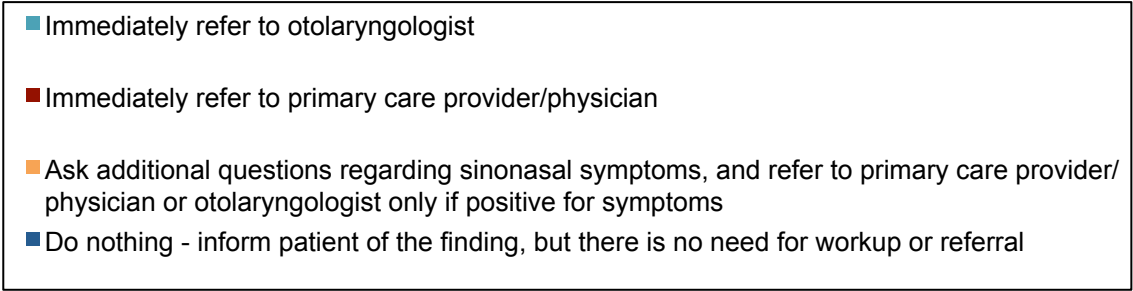
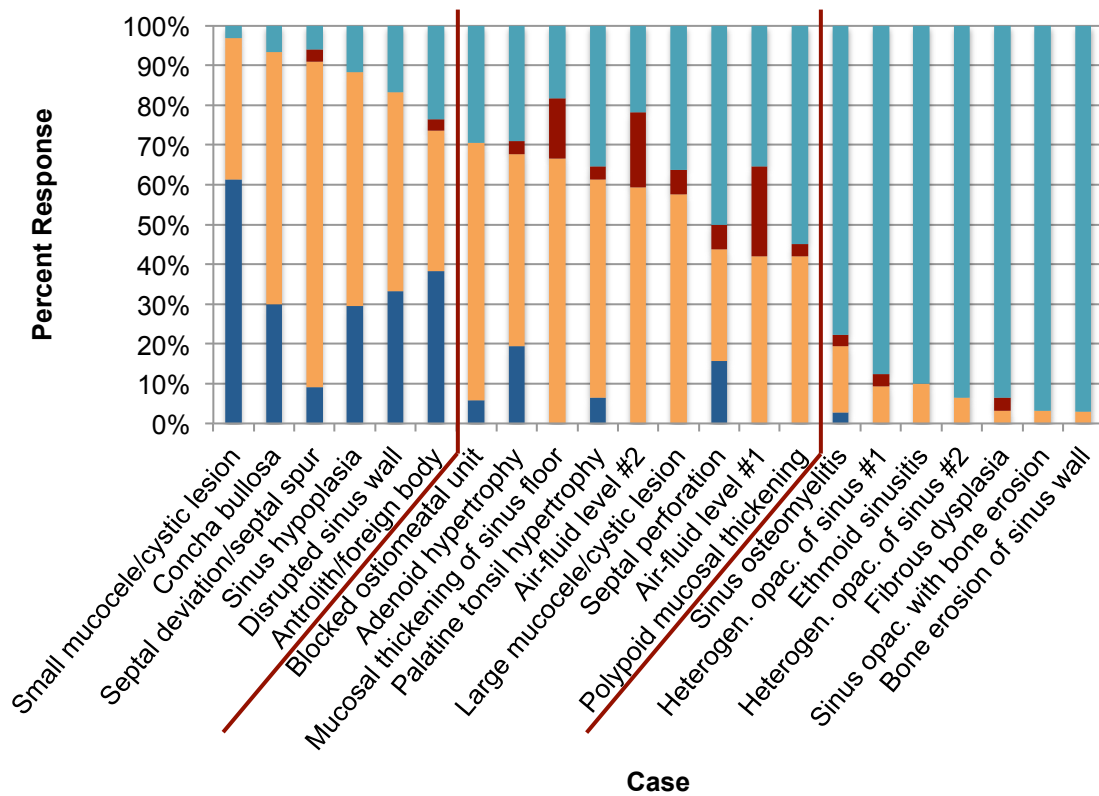
- Sinus osteomyelitis
- Heterogeneous opacification of the maxillary sinus (#1 and #2)
- Ethmoid sinusitis
- Fibrous dysplasia
- Sinus opacification with bone erosion
- Bone erosion of the sinus wall

The remaining cases all had recommendations to ask about symptoms prior to referring for follow up, or to refer immediately to the otolaryngologist.

These findings include:

- Blocked ostiomeatal unit
- Adenoid hypertrophy
- Mucosal thickening of sinus floor
- Palatine tonsil hypertrophy
- Air-fluid level (#1 and #2)
- Large mucocele/cystic lesion
- Septal perforation
- Polypoid mucosal thickening

Figure 2. Survey case recommendations by otolaryngologists.



For findings of mucosal thickening of sinus floor and both air-fluid levels (#1 and #2), a notable number of recommendations were made to immediately refer the patient to their primary care provider. However, for none of these did this recommendation outweigh the recommendation to refer the patient

immediately to the otolaryngologist.

Table III lists the *p*-values of associations between case response frequencies and years in practice or location of training. Only two cases (sinus osteomyelitis, *p* = 0.0373; and small mucocele/cystic lesion, *p* = 0.0338) were significantly associated with years in practice. Regarding sinus osteomyelitis, the vast majority of respondents in both the 0–5 year group and 6–20 year group recommended immediate referral to the otolaryngologist, whereas those in the 20+ year group were not so polarized. Regarding small mucocele/cystic lesion, a majority of respondents in the 6–20 year group recommended to take no action, whereas the 0–5 year group was split between recommending taking no action and referring after further questions were asked, and a majority of the 20+ year group recommended referring after asking further questions. There were no cases significantly associated with the location of training.

Table III. *P*-values of associations between case response frequencies and years in practice or location of training.

Case Finding	<i>p</i>-value, Years in Practice	<i>p</i>-value, Location of Training
Adenoid hypertrophy	0.9739	0.0561
Air-fluid level #1	0.3851	0.2711
Air-fluid level #2	0.3744	0.0706
Antrolith/foreign body	0.3814	0.4380
Blocked ostiomeatal unit	0.3885	1.0000
Bone erosion of sinus wall	1.0000	1.0000
Concha bullosa	0.1429	0.5676
Disrupted sinus wall	0.5189	0.1257
Ethmoid sinusitis	0.5310	1.0000
Fibrous dysplasia	1.0000	1.0000
Heterogeneous opacification of maxillary sinus #1	0.6383	0.6676
Heterogeneous opacification of maxillary sinus #2	1.0000	1.0000
Large mucocele/cystic lesion	0.7109	0.8452
Mucosal thickening of sinus floor	0.6355	1.0000
Palatine tonsil hypertrophy	0.5107	1.0000
Polypoid mucosal thickening	0.7762	1.0000
Septal deviation/septal spur	0.5241	1.0000
Septal perforation	0.2123	0.7135
Sinus hypoplasia	0.4297	1.0000
Sinus opacification with bone erosion	0.1290	1.0000
Sinus osteomyelitis	0.0373^a	0.4137
Small mucocele/cystic lesion	0.0338^a	0.7779

^a Statistically Significant ($p \leq 0.05$)

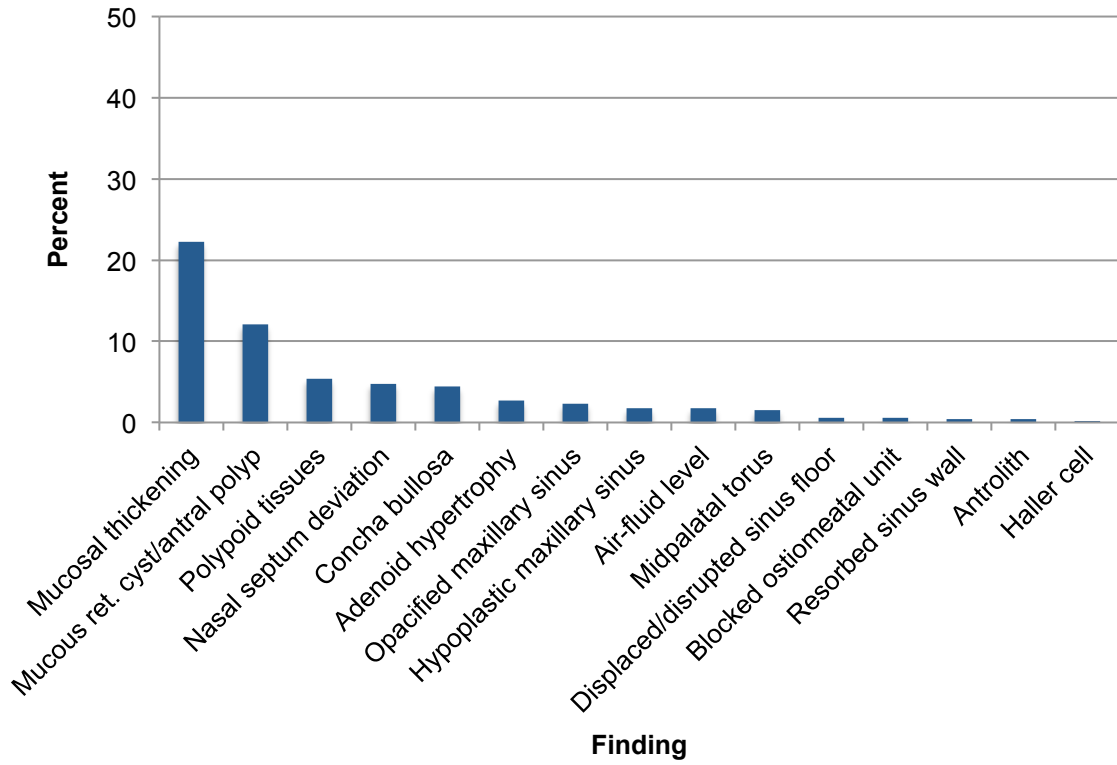
With regard to incidental findings in an orthodontic population treated at the University of Minnesota, a review of CBCT reports yielded the following results:

Of 802 total reports available in 2014, 551 were used in this study based on patient consent. Four reports were excluded due to another scan of the patient occurring earlier in the year. Twenty-two reports were excluded due to cleft lip/palate or craniofacial conditions, and three reports were excluded for having 'partially recorded' sinuses. This yielded 522 reports to include in this study.

There were 307 (58.8%) females and 215 (41.2%) males, and a total of 281 (53.8%) patients with maxillary sinus or airway findings listed. At 62.3%, the proportion of males with positive findings was greater than that of females (47.9%).

The frequency of findings is shown in Figure 3. The most prevalent findings were mucosal thickening (22.2%) and mucous retention cyst/antral polyp (12.1%). Findings with a lower prevalence included polypoid tissues (5.4%), nasal septum deviation (4.8%), and concha bullosa (4.4%). The remaining findings in this review all had frequencies under 3%.

Figure 3. Prevalence of incidental maxillary sinus and airway findings on CBCT analysis in 2014.



Discussion

The present study evaluated recommended referral patterns by otolaryngologists to dentists for incidental maxillary sinus and airway findings on CBCT analysis. The frequency of incidental maxillary sinus and airway findings on CBCT analysis in an orthodontic population at the University of Minnesota was also reported. Health care providers have an ethical and legal obligation to identify and manage all findings seen on the radiological scans they order. For dentists, this includes incidental findings, particularly those commonly found in the paranasal sinuses and airway. Consultation with managing specialists, in this case otolaryngologists, regarding the need for follow up of incidental findings has provided more insight on the appropriate management of maxillary sinus and airway findings as found on CBCT analysis. Namely, when sinus and airway findings are present on CBCT, otolaryngologists generally recommend that dentists evaluate patients for related symptoms, and refer patients to an otolaryngologist for follow up.

For the primary aim of the present study, the survey used was designed to examine otolaryngologists' clinical opinions and recommendations regarding incidental CBCT findings. To minimize measurement error, a pilot group of otolaryngologists was used to test the survey design, including question wording and image quality. No changes were made to the survey design prior to its distribution because the pilot test data showed interpretable trends, the average time it took to complete the survey was acceptable at approximately 10 minutes,

and there was no feedback regarding question wording or image quality. Also, the only survey mode was electronic and distributed through email (*i.e.* the survey was not distributed by any other means, such as mailings or phone calls), further reducing the potential for measurement error.

Questionnaire fatigue is another potential bias in surveys. This survey included three background questions and 22 case questions, and was estimated to take approximately 10 minutes. In order to avoid overburdening participants, only two reminder emails and one reminder announcement were delivered during the eight-week surveying period. Additionally, a test-retest of the survey may have allowed for examination of respondent reliability, however, this was avoided to minimize survey fatigue.

The results of the primary aim included responses from 36 otolaryngologists, most of whom were general otolaryngologists trained in the Midwest, and more than five years into their career. While recommendations varied for many cases in the survey, there were notable trends in the results (Figure 2). The most commonly recommended actions were 1) to immediately refer the patient to an otolaryngologist, and 2) to ask additional questions regarding sinonasal symptoms and then refer. The least commonly recommended action was to immediately refer the patient to the primary care provider.

Furthermore, every case had at least one respondent recommend immediate follow up to an otolaryngologist, and 50% of all recommendations

were for immediate follow up to a physician or specialist. This notably high proportion of recommendations for follow up contrasts with the currently reported prevalence of incidental airway and sinus findings that require follow up; a range of 6.8% to 26.4% (Pliska *et al*, 2011; Price *et al*, 2012; Drage *et al*, 2013; Dođramıcı *et al*, 2014).

There were a number of cases for which the majority of respondents recommended immediate referral to the otolaryngologist. These include sinus osteomyelitis, ethmoid sinusitis, both cases of heterogeneous opacification of the maxillary sinus (#1 and #2), fibrous dysplasia, sinus opacification with bone erosion, and bone erosion of the sinus wall. Not surprisingly, these findings share common characteristics that may warrant immediate referral to a specialist. Such characteristics involve changes of a bony wall, and include increased bony thickness, changes in bone consistency, and bone destruction. The present results concur with a report from Miles and Danforth (2014) on when to refer a patient for follow up. Namely, expansion or displacement of the sinus wall, destruction of the bony wall, or thickening (hyperostosis) of any wall necessitate referral to a specialist (Miles and Danforth, 2014).

On the contrary, there were several cases for which the majority of respondents recommended taking no further action beyond informing the patient of the incidental finding, or asking additional questions regarding sinonasal symptoms and only then referring the patient. These include small mucocele/cystic lesion, concha bullosa, septal deviation/septal spur, sinus

hypoplasia, and antrolith/foreign body. A possible explanation for this trend is that these particular findings may be considered an anatomic variant rather than pathology of the maxillary sinus. In studies by Lana *et al* (2012) and Vogiatzi *et al* (2014), findings such as a deviated nasal septum, concha bullosa, sinus hypoplasia, sinus pneumatization, sinus septa, and exostosis were considered to be anatomic variations of a healthy maxillary sinus. Data from the present study indicate that otolaryngologists regard these types of findings to be less severe and not requiring referral unless the patient has related symptoms.

Regarding the case of a disrupted sinus wall, a majority of the recommendations were for immediate referral to an otolaryngologist. However, the next most common recommendation was to take no further action beyond informing the patient of the incidental finding. Based on the comments, it appeared that a number of survey participants suspected prior surgery and advised for no further action. Although, if there was no patient history of prior surgery, an immediate referral to the otolaryngologist was warranted.

The remaining cases all tended towards a high proportion of respondents recommending to ask additional questions before referring, and to immediately refer to the otolaryngologist. These include blocked ostiomeatal unit, adenoid hypertrophy, mucosal thickening of sinus floor, palatine tonsil hypertrophy, both cases of air-fluid level (#1 and #2), large mucocele/cystic lesion, septal perforation, and polypoid mucosal thickening. These findings, while generally not considered to be variants of normal, share characteristics common to transient

inflammatory conditions. As the present data indicate, more information is needed to best manage the patient's care due to the varying degrees of seriousness these findings present.

Because the cases in the present survey did not include any patient history or reported symptoms, appropriate identification and management of incidental findings was more difficult. This may explain the high prevalence of cases for which a recommendation was made to ask the patient more questions regarding symptoms. Additionally, the notable difference of recommendation between referral to a specialist versus referral to a primary care provider may indicate a bias for the otolaryngologists to advise referring to themselves. Alternatively, it may simply represent a recommendation to refer the patient for follow up to 'be on the safe side' – a trend in results reflecting the fact that no patient history or symptoms were included with the survey images.

Moreover, it was apparent from the respondents' comments that even when referring the patient immediately for follow up, dentists were advised to ask questions regarding sinonasal symptoms. There were also clarifications for a number of cases that referral to the otolaryngologist was recommended although the case was not urgent in nature. For example, responders wrote for a large mucocele/cystic lesion: "doesn't need to be immediate, not urgent consult," and "probably asymptomatic but good to refer; dentist shouldn't have to take on responsibility of explaining an incidental finding especially if later on it becomes an issue." For heterogeneous opacification of the maxillary sinus #1 responders

wrote: “not an urgent consult,” and, “again, probably nothing to do about it but better explained by ENT; not sure there needs to be an ‘immediate’ referral.” And for sinus osteomyelitis: “not an urgent consult but appropriate to refer to ENT.” These results confirm the importance of interpreting findings “in light of the clinical history and symptoms gathered by an expert clinician,” as suggested by Cha *et al* (2007).

Further analysis of the survey results involved evaluating for correlations between respondent backgrounds, including years in clinical practice and location of their training, and trends in their responses to each of the survey cases. As previously mentioned, the responses were grouped to reduce statistical complexity and to compare certain groups with different demographics. Statistically significant associations were found for osteomyelitis and small mucocele/cystic lesions with years of practice. This may reflect a change in diagnosis or management criteria for these findings over time, however, there is also a possibility that these associations occurred by chance due to the high number of statistical tests ran. In contrast, the vast majority of findings demonstrated no association between years of practice or location of training with case response trends.

In regards to the sample population for the primary study aim, there is potential risk of coverage and sampling error in that the sample of otolaryngologists tested was accessed through the MAO. This group was selected based on the convenience of accessibility, and it included over two-

thirds of all otolaryngologists practicing in Minnesota. On the other hand, the representativeness of the respondents is unknown, as demographic data for the study population was unavailable. For more complete data, future studies in this field of research should evaluate otolaryngologists from all regions of the nation, and improve means to ensure a representative sample. For example, a larger survey would allow for all regions to be represented as well as for better comparisons in practice philosophy based on regional differences.

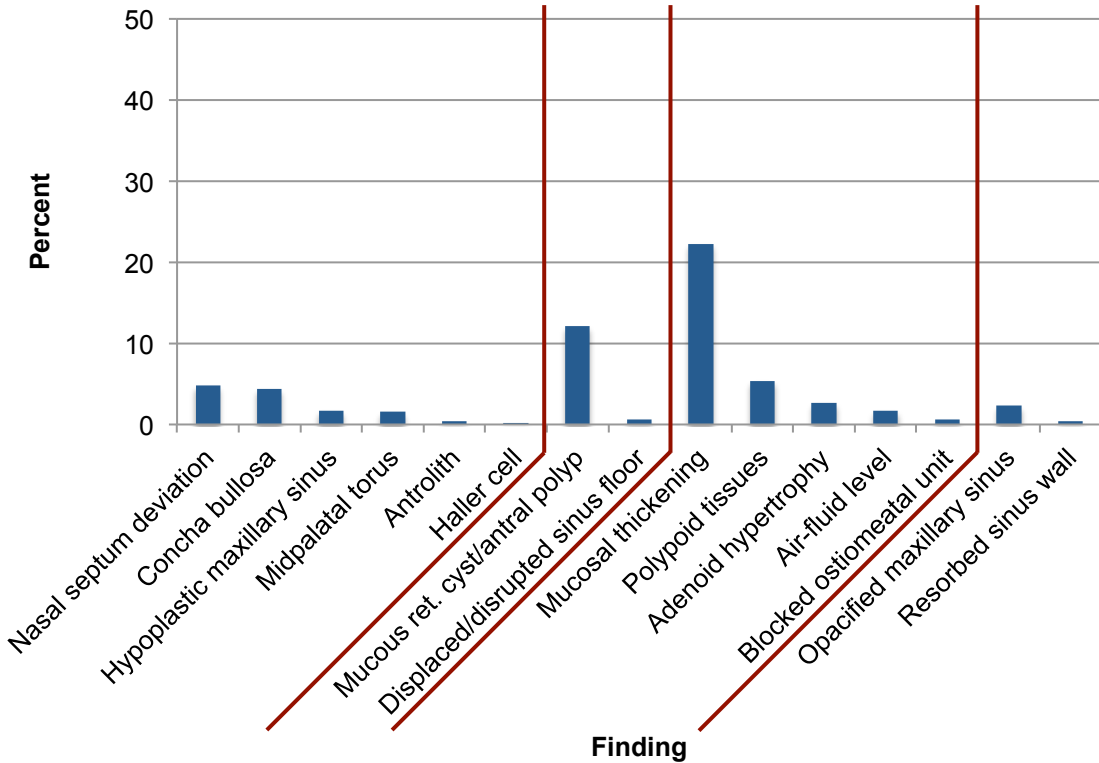
For the secondary aim of the present study, data on the frequency of maxillary sinus and airway findings in a one-year review of University of Minnesota orthodontic patients yielded results quite comparable to those published in literature. While a greater number of the patients having CBCT reports in 2014 were female (58.8%), a greater proportion of patients positive for maxillary sinus and airway findings was male (62.3%). This corresponds to the higher prevalence of sinus pathology in men over women that has been reported (Ritter *et al*, 2011; Gracco *et al*, 2012; Rege *et al*, 2012; Vogiatzi *et al*, 2014). The overall prevalence of sinus and airway findings on CBCT analysis was 60.9%; a comparable figure to the range of 14.3% to 82% that has been published (Ritter *et al*, 2011; Gracco *et al*, 2012; Lana *et al*, 2012; Rege *et al*, 2012; Dobeles *et al*, 2013; Raghav *et al*, 2014; Vogiatzi *et al*, 2014). At 22.2%, the prevalence of mucosal thickening, which was the most common finding, was near the 24% to 66% range reported in literature (Ritter *et al*, 2011; Gracco *et al*, 2012; Lana *et al*, 2012; Rege *et al*, 2012; Dobeles *et al*, 2013; Raghav *et al*, 2014; Vogiatzi *et al*,

2014). As indicated by these results, the present sample compared well to and was validated by other samples previously studied. To conclude, dental professionals ordering CBCT scans must be prepared to manage incidental sinus and airway findings since they will likely be encountered.

Some limitations are noted with respect to the secondary study aim. First, the CBCT reports were generated by one of two OMFRs. While these radiologists are board certified, there was no clinical or retrospective analysis done to ensure that the diagnoses were correct. Furthermore, inherent inter- and intrareliability limitations may exist as there was no evaluation of this in the present study. In future studies on CBCT analysis and incidental findings, reliability testing would eliminate this unknown and may validate study results.

There is more to be learned when considering both study components together. Using the present sample of orthodontic patients along with the recommended referral patterns for sinus and airway findings, commonly found findings may be categorized based on their need for follow up (Figure 4). According to otolaryngologists' recommendations, approximately 21.4% to 42.1% of incidental maxillary sinus and airway findings need no follow up unless the patient has related sinonasal symptoms. These findings tend to be variants of normal, and include nasal septum deviation, concha bullosa, sinus hypoplasia, midpalatal torus, antrolith, and Haller cell.

Figure 4. Incidental maxillary sinus and airway findings grouped by referral recommendations.



Alternatively, 53.5% to 74.2% of incidental sinus and airway findings do need follow up, especially if the patient has related symptoms. These findings demonstrate inflammatory conditions, and include mucosal thickening, polypoid tissues, adenoid hypertrophy, air-fluid level, and blocked ostiomeatal unit.

Findings of mucous retention cyst/antral polyp and displaced/disrupted sinus wall have varying recommendations depending on more specific characteristics, such as the size of the mucous retention cyst or whether the sinus wall was surgically disrupted. For findings of a small mucocele/cystic lesion

and surgically disrupted sinus wall, the recommendations were for no follow up. However, for a large mucocele/cystic lesion, otolaryngologists recommended to ask the patient questions regarding related symptoms and refer for follow up. Similarly, for a disrupted sinus wall without a prior history of surgery, immediate follow up to the otolaryngologist was recommended.

For the remaining 4.4% of findings, otolaryngologists recommended to immediately refer the patient for follow up. These findings include an opacified maxillary sinus and a resorbed sinus wall – findings considered more severe and needing management.

As evidenced by this distribution of findings, most incidental maxillary sinus and airway findings found in orthodontic patients on CBCT analysis will require the dental professional to ask further questions and refer the patient for follow up. It is rare – but still a possibility – that the orthodontist will need to make an immediate referral to the otolaryngologist for an incidental sinus or airway finding. These results reinforce the need for all dental professionals to use their clinical training to carefully investigate incidental findings and any related patient characteristics or symptoms, particularly of the paranasal sinuses and airway, and to consult with an appropriate specialist for follow up as needed.

Another consideration of the present study as a whole arises from the nomenclature of the findings. The cases selected for the survey were done so based on commonly reported findings in published literature, the intent to include a variety of case types, and the use of CBCT files available through the OMFR

and orthodontic departments involved in the study. Moreover, each case was named using otolaryngological terms. In contrast, the names of findings in the secondary aim were provided by the OMFRs who generated the CBCT reports. As shown in Table IV, there was an attempt to correspond the survey case findings with the reported CBCT incidental findings. However, not every case tested in the survey was reported in the second aim, and there was an appreciable difference in the nomenclature used between dental and medical fields. As evidenced by the present study, identification of universally accepted definitions for findings on CBCT is necessary to improve communication across the dental and medical fields.

Table IV. List of maxillary sinus and airway cases evaluated in the survey, and linked incidental findings identified on CBCT reports.

Survey Case Finding	Reported Incidental Finding
Adenoid hypertrophy	Adenoid hypertrophy
Air-fluid level #1	Air-fluid level
Air-fluid level #2	Air-fluid level
Antrolith/foreign body	Antrolith
Blocked ostiomeatal unit	Blocked ostiomeatal unit
Bone erosion of sinus wall	Resorbed sinus wall
Concha bullosa	Concha bullosa
Disrupted sinus wall	Resorbed sinus wall
Ethmoid sinusitis	Not noted
Fibrous dysplasia	Not noted
Heterogeneous opacification of sinus #1	Not noted
Heterogeneous opacification of sinus #2	Not noted
Large mucocele/cystic lesion	Mucous retention cyst/antral polyp
Mucosal thickening of sinus floor	Mucosal thickening
Palatine tonsil hypertrophy	Not noted
Polypoid mucosal thickening	Polypoid tissues
Septal deviation/septal spur	Nasal septum deviation
Septal perforation	Not noted
Sinus hypoplasia	Hypoplastic maxillary sinus
Sinus opacification with bone erosion	Opacified maxillary sinus
Sinus osteomyelitis	Not noted
Small mucocele/cystic lesion	Mucous retention cyst/antral polyp

The main benefit of this study has been to report on recommendations from practicing otolaryngologists regarding incidental maxillary sinus and airway findings on CBCT analysis; a unique and relevant perspective that no prior study has addressed. The findings of this study may help dental professionals better manage incidental findings found on CBCT, as well as improve the relationship between dental and otolaryngology professionals, whose fields of study frequently overlap.

Conclusions

Incidental maxillary sinus and airway findings are commonly found on CBCT analysis, reinforcing the need for best management practices to be adopted. When such findings are identified on CBCT scans, the general recommendation from otolaryngologists is to evaluate the patient for further symptoms, and to refer the patient to an otolaryngologist for follow up. Specifically, for findings that are variants of normal, the dentist is recommended to not refer the patient for follow up unless they are positive for sinonasal symptoms. For findings that demonstrate inflammatory conditions, the dentist is recommended to refer the patient for follow up, especially if they have sinonasal symptoms. For findings with changes in the bony wall of the sinuses, the dentist is recommended to immediately refer the patient to the otolaryngologist for follow up. Consultation with an oral and maxillofacial radiologist or otolaryngologist is recommended for dental professionals to best manage incidental sinus and airway findings present on CBCT analysis.

References

1. Ahmad M, Freymiller E. Cone beam computed tomography: evaluation of maxillofacial pathology. *J Calif Dent Assoc* 2010;38:41–47.
2. Ahmed F, Brooks SL, Kapila SD. Efficacy of identifying maxillofacial lesions in cone-beam computed tomography by orthodontists and orthodontic residents with third-party software. *Am J Orthod Dentofacial Orthop* 2012;141:451–459.
3. Brüllman DD, Schmidtman I, Hornstein S, Schulze RK. Correlation of cone beam computed tomography (CBCT) findings in the maxillary sinus with dental diagnoses: a retrospective cross-sectional study. *Clin Oral Invest* 2012;16:1023–1029.
4. Buck LM, Dalci O, Darendeliler MA, Papadopoulou AK. Effect of surgically assisted rapid maxillary expansion on upper airway volume: a systematic review. *J Oral Maxillofac Surg* 2016a;74:1025–1043.
5. Buck LM, Dalci O, Darendeliler MA, Papageorgiou SN, Papadopoulou AK. Volumetric upper airway changes after rapid maxillary expansion: a systematic review and meta-analysis. *Eur J Orthod* 2016b;cjw048.
6. Cagayan F, Tozoglu U. Incidental findings in the maxillofacial region detected by cone beam CT. *Diagn Interv Radiol* 2012;18:159–163.
7. Cha JY, Mah J, Sinclair P. Incidental findings in the maxillofacial area with 3-dimensional cone-beam imaging. *Am J Orthod Dentofacial Orthop* 2007;132:7–14.
8. Christovam IO, Lisboa CO, Ferreira DM, Cury-Saramago AA, Mattos CT. Upper airway dimensions in patients undergoing orthognathic surgery: a systematic review and meta-analysis. *Int J Oral Maxillofac Surg* 2016;45:460–471.
9. Cunningham CT, Quan H, Hemmelgarn B, Noseworthy T, Beck CA, Dixon E, Samuel S, Ghali WA, Sykes LL, Jetté N. Exploring physician specialist response rates to web-based surveys. *BMC Med Res Methodol* 2015;15:32.
10. De Vos W, Casselman J, Swennen GR. Cone-beam computerized tomography (CBCT) imaging of the oral and maxillofacial region: a systematic review of the literature. *Int J Oral Maxillofac Surg* 2009;38:609–625.
11. Dobelev I, Kise, L, Apse P, Kragis G, Bigestans A. Radiographic assessment of findings in the maxillary sinus using cone-beam computed tomography. *Stomatologija* 2013;15:119–122.
12. Dođramić EJ, Rossi-Fedele G, McDonald F. Clinical importance of incidental

- findings reported on small-volume dental cone beam computed tomography scans focused on impacted maxillary canine teeth. *Oral Surg Oral Med Oral Pathol Oral Radiol* 2014;118:e205–e209.
13. Drage N, Rogers S, Greenall C, Playle R. Incidental findings on cone beam computed tomography in orthodontic patients. *J Orthod* 2013;40:29–37.
 14. Edwards R, Alsufyani N, Heo G, Flores-Mir C. Agreement among orthodontists experienced with cone-beam computed tomography on the need for follow-up and the clinical impact of craniofacial findings from multiplanar and 3-dimensional reconstructed views. *Am J Orthod Dentofacial Orthop* 2015;148:264–273.
 15. Edwards R, Alsufyani N, Heo G, Flores-Mir C. The frequency and nature of incidental findings in large-field cone beam computed tomography scans of an orthodontic sample. *Prog Orthod* 2014;15:37.
 16. Eggman F, Connert T, Bühler J, Dagassan-Berndt D, Weiger R, Walter C. Do periapical and periodontal pathologies affect Schneiderian membrane appearance? Systematic review of studies using cone-beam computed tomography. *Clin Oral Investig* 2017;5:1611–1630.
 17. Farman AG, Scarfe WC. The basics of maxillofacial cone beam computed tomography. *Semin Orthod* 2009;15:2–13.
 18. Gracco A, Incerti Parenti S, Ioele C, Alessandri Bonetti G, Stellini E. Prevalence of incidental maxillary sinus findings in Italian orthodontic patients: a retrospective cone-beam computed tomography study. *Korean J Orthod* 2012;42:329–334.
 19. Kapila S, Conley RS, Harrell WE Jr. The current status of cone beam computed tomography imaging in orthodontics. *Dentomaxillofac Radiol* 2011;40:24–34.
 20. Kellerman SE, Herold J. Physician response to surveys: a review of the literature. *Am J Prev Med* 2001;20:61–67.
 21. Lana JP, Carnerio PM, Machado Vde C, de Souza PE, Manzi FR, Horta MC. Anatomic variations and lesions of the maxillary sinus detected in cone beam computed tomography for dental implants. *Clin Oral Implants Res* 2012;23:1398–1403.
 22. Leece P, Bhandari M, Sprague S, Swiontkowski MF, Schemitsch EH, Tornetta P, Devereaux PJ, Guyatt GH. Internet versus mailed questionnaires: a controlled comparison (2). *J Med Internet Res* 2004;6:e39.
 23. Li G. Patient radiation dose and protection from cone-beam computed tomography.

- Imaging Sci Dent 2013;43:63–69.
24. Lu Y, Liu Z, Zhou X, Zheng Q, Duan X, Zheng G, Wang H, Huang D. Associations between maxillary sinus mucosal thickening and apical periodontitis using cone-beam computed tomography scanning: a retrospective study. *J Endod* 2012;38:1069–1074.
 25. Ludlow JB, Timothy R, Walker C, Hunter R, Benavides E, Samuelson DB, Scheske MJ. Effective dose of dental CBCT – a meta analysis of published data and additional data for nine CBCT units. *Dentomaxillofac Radiol* 2015;44:20140197.
 26. Miles DA, Danforth RA. Reporting findings in the cone beam computed tomography volume. *Dent Clin N Am* 2014;58:687–709.
 27. Nakash RA, Hutton JL, Jørstad-Stein EC, Gates S, Lamb SE. Maximising response to postal questionnaires – a systematic review of randomised trials in health research. *BMC Med Res Methodol* 2006;6:5.
 28. Nascimento EH, Pontual ML, Pontual AA, Freitas DQ, Perez DE, Ramos-Perez FM. Association between odontogenic conditions and maxillary sinus disease: a study using cone-beam computed tomography. *J Endod* 2016;42:1509–1515.
 29. Pacheco-Pereira C, Alsufyani NA, Major MP, Flores-Mir C. Accuracy and reliability of oral maxillofacial radiologists when evaluating cone-beam computed tomography imaging for adenoid hypertrophy screening: a comparison with nasopharyngoscopy. *Oral Surg Oral Med Oral Pathol Oral Radiol* 2016a;121:e168–e174.
 30. Pacheco-Pereira C, Alsufyani NA, Major M, Heo G, Flores-Mir C. Accuracy and reliability of orthodontists using cone-beam computerized tomography for assessment of adenoid hypertrophy. *Am J Orthod Dentofacial Orthop* 2016b;150:782–788.
 31. Parsons JA, Warnecke RB, Czaja RF, Barnsley J, Kaluzny A. Factors associated with response rates in a national survey of primary care physicians. *Eval Rev* 1994;18:756–766.
 32. Phothikun S, Suphanantachat S, Chuenchompoonut V, Nisapakultorn K. Cone-beam computed tomographic evidence of the association between periodontal bone loss and mucosal thickening of the maxillary sinus. *J Periodontol* 2012;83:557–564.
 33. Pliska B, DeRocher M, Larson BE. Incidence of significant findings on CBCT scans of an orthodontic patient population. *Northwest Dent* 2011;90:12–16.
 34. Price JB, Thaw KL, Tyndall DA, Ludlow JB, Padilla RJ. Incidental findings from cone

- beam computed tomography of the maxillofacial region: a descriptive retrospective study. *Clin Oral Impl Res* 2012;23:1261–1268.
35. Raghav M, Karjodkar FR, Sontakke S, Sansare K. Prevalence of incidental maxillary sinus pathologies in dental patients on cone-beam computed tomographic images. *Contemp Clin Dent* 2014;5:361–365.
 36. Rege IC, Sousa TO, Leles CR, Mendonca EF. Occurrence of maxillary sinus abnormalities detected by cone beam CT in asymptomatic patients. *BMC Oral Health* 2012;12:30.
 37. Ritter L, Lutz J, Neugebauer J, Scheer M, Dreiseidler T, Zinser MJ, Rothamel D, Mischkowski RA. Prevalence of pathologic findings in the maxillary sinus in cone-beam computerized tomography. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2011;111:634–640.
 38. Rosário HD, Oliveira GM, Freires IA, Matos, FS, Paranhos LR. Efficiency of bimaxillary advancement surgery in increasing the volume of the upper airways: a systematic review of observational studies and meta-analysis. *Eur Arch Otorhinolaryngol* 2017;274:35–44.
 39. Shanbhag S, Karnik P, Shirke P, Shanbhag V. Association between periapical lesions and maxillary sinus mucosal thickening: a retrospective cone-beam computed tomographic study. *J Endod* 2013;39:853–857.
 40. Shelley AM, Brunton P, Horner K. Questionnaire surveys of dentists on radiology. *Dentomaxillofac Radiol* 2012;41:267–275.
 41. Tetradis S, White S. A decade of cone beam computed tomography. *J Calif Dent Assoc* 2010;38:25–32.
 42. VanGeest JB, Johnson TP, Welch VL. Methodologies for improving response rates in surveys of physicians: a systematic review. *Eval Health Prof* 2007;30:303–321.
 43. Vogiatzi T, Kloukos D, Scarfe WC, Bernstein MM. Incidence of anatomical variations and disease of the maxillary sinus as identified by cone beam computed tomography: a systematic review. *Int J Oral Maxillofac Implants* 2014;29:1301–1314.
 44. White SC, Pharoah MJ. The evolution and application of dental and maxillofacial imaging modalities. *Dent Clin N Am* 2008;52:689–705.
 45. Zinman E, White S, Tetradis S. Legal considerations in the use of cone beam computer tomography imaging. *J Calif Dent Assoc* 2010;38:49–56.

Appendix A: Complete Survey and Individual Case Response Results

Survey Introduction



Hello,

My name is Sara Gaalaas, and I am a graduate student at the University of Minnesota in the Division of Orthodontics. With my research team of Brent Larson, DDS, MS; Holly Boyer, MD; and Laurence Gaalaas, DDS, MS; I am conducting research on the decision-making process of referring a patient for appropriate follow-up when abnormal maxillary sinus and airway findings are present on cone-beam computed tomography (CBCT) analysis. We would like to invite you to participate in this study because of your professional training as an otolaryngologist.

Participation in this research includes completing an electronic survey about your referral recommendations for CBCT incidental findings, as well as about your professional background (location of education, practice specialty and years practicing). The estimated length of the survey is approximately 10 minutes.

I hope you will consider completing this survey. For more information, please refer to the Consent Form provided prior to the survey. Please contact me with any questions or concerns at gaal0019@umn.edu.

Thank you,

Sara A. Gaalaas, DDS

Student Principal Investigator



Survey Consent



UNIVERSITY OF MINNESOTA
Driven to Discover™

CONSENT FORM

Survey of recommended referral patterns for incidental maxillary sinus and airway findings on CBCT analysis in an orthodontic population

You are invited to participate in a research study of the decision-making process of referring a patient for appropriate follow-up when abnormal maxillary sinus and airway findings are present on cone-beam computed tomography (CBCT) analysis. You were selected as a possible participant because you identify as a trained, certified otolaryngologist. We ask that you read this form and ask any questions you may have before agreeing to be in the study.

This study is being conducted by Sara A. Gaalaas, DDS, University of Minnesota, Department of Developmental and Surgical Sciences, Division of Orthodontics, as part of a graduate program requirement.

Study Purpose

The purpose of the study is to identify which incidental maxillary sinus and/or airway findings the otolaryngologist would recommend the dentist to 1) do nothing - inform the patient of the finding, but no need to proceed with workup or referral, 2) ask additional questions regarding sinonasal symptoms, and refer to primary care provider/physician or otolaryngologist only if positive for related symptoms, 3) immediately refer to primary care provider/physician, or 4) immediately refer to otolaryngologist; and to subsequently develop a guide based on these recommendations in order to identify maxillary sinus and airway pathology on CBCT analysis and to aid in decision-making for further evaluation.

Study Procedures

If you agree to participate in this study, we would ask you to do the following: Complete the following survey, which includes questions regarding subject training and demographics, and questions regarding recommended referral practices based on representative cases of various maxillary sinus and airway pathology as found in CBCT analysis.

Risks of Study Participation

The study has the following risks: Collection of professional opinions from otolaryngologists pertaining to maxillary sinus and airway findings on CBCT analysis, which could result in minor annoyance to the otolaryngologists because of the time commitment to perform the survey.

Benefits of Study Participation

The benefits to study participation are: To establish more appropriate referral protocols with regards to incidental maxillary sinus and airway findings on CBCT analysis. With this information, orthodontic and other dental professionals who encounter an abnormal maxillary sinus and/or airway finding will be able to properly inform/refer the patient with improved accuracy and efficiency. A secondary benefit of this study is the establishment of an improved relationship between the dental professionals and otolaryngology professionals, whose fields of study frequently overlap.

Study Costs/Compensation

The main cost of this study is the time commitment involved in completing the survey. There is no financial compensation for your time to participate in this study.

Research Related Injury

The anticipated risks are minimal relative to the anticipated benefits (see sections above on Risks and Benefits of Study Participation). There is no anticipated injury related to participating in this research beyond the risks listed above.

Confidentiality

For this study, the data will be collected anonymously, and the records will be kept private. In any publications or presentations, we will not include any information that will make it possible to identify you as a subject. Your record for the study may, however, be reviewed by the principal investigator and supporting research personnel, and by departments at the University with appropriate regulatory oversight. The study information will not be recorded in the your medical record. As this survey is provided to you via the Internet, the data, including your responses, will be anonymously collected and transmitted via the Internet. To these extents, confidentiality is not absolute. Study data will be encrypted according to current University policy for protection of confidentiality.

Voluntary Nature of the Study

Participation in this study is voluntary. Your decision whether or not to participate in this study will not affect your current or future relations with the University of Minnesota School of Dentistry, Division of Orthodontics. If you decide to participate, you are free to withdraw at any time without affecting those relationships.

Contacts and Questions

The researchers conducting this study are Sara A. Gaalaas, DDS; Brent E. Larson, DDS, MS; Holly C. Boyer, MD; and Laurence R. Gaalaas, DDS, MS. You may ask any questions you have now, or if you have questions later, **you are encouraged to** contact Dr. Sara Gaalaas, Student Principal Investigator, at gaal0019@umn.edu, or Dr. Brent Larson, Faculty Academic Advisor, at larso121@umn.edu.

If you have any questions or concerns regarding the study and would like to talk to someone other than the researcher(s), you are encouraged to contact the Research Subjects' Advocate Line, D-528 Mayo, 420 Delaware Street S.E., Minneapolis, Minnesota, 55455; telephone (612) 625-1650.

You will be given a copy of this form to keep for your records.

[Consent Form Copy](#)

Statement of Consent

I have read the above information. I have asked questions and have received answers.

- Yes, I consent to participate in the study.
- No, I do not consent to participate in the study.

<<

>>

Background Survey Questions



UNIVERSITY OF MINNESOTA
Driven to Discover™

BACKGROUND

Please identify the number of years in clinical practice you have for otolaryngology.

- 0-5 years
- 6-10 years
- 11-15 years
- 16-20 years
- 21-25 years
- 26-30 years
- 30+ years

<<

>>



BACKGROUND

Please identify the location of your otolaryngology training.

- West (Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming)
- Midwest (Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin)
- Northeast (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, New Jersey, New York, Pennsylvania)
- South (Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, Washington D.C., West Virginia)
- Other than United States

Please identify the location of your otolaryngology training if other than the United States.





BACKGROUND

Please identify your specialty/-ies.

- Audiology
- Broncho-esophagology
- Endocrine surgery (thyroid/parathyroid)
- Facial plastic & reconstructive surgery
- General otolaryngology
- Head & neck surgery
- Laryngology
- Maxillofacial surgery
- Neurotology
- Otolaryngic allergy
- Otolaryngic pathology
- Otology
- Pediatric otolaryngology
- Rhinology
- Skull base surgery
- Sleep medicine
- Other

Please identify your specialty/-ies if other than listed.



Survey Cases



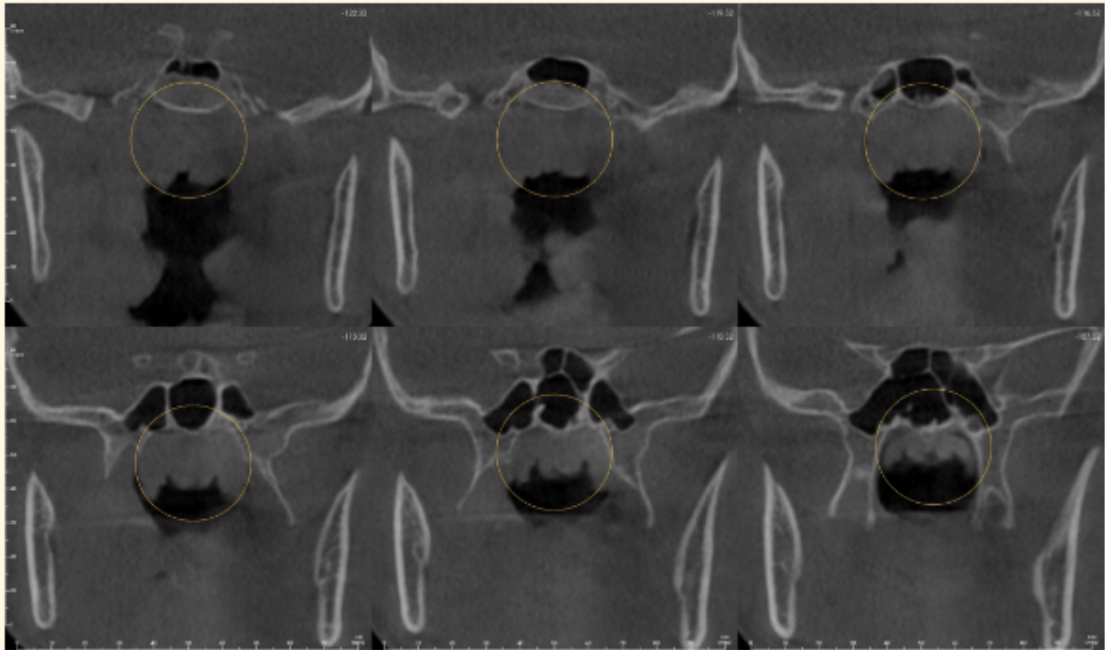
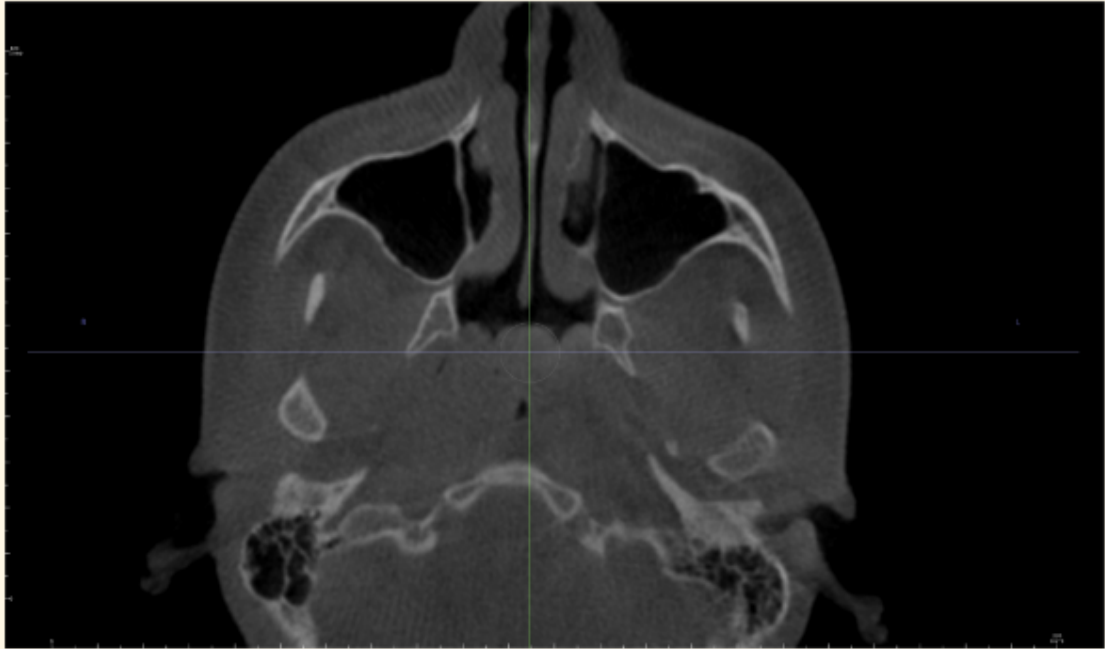
UNIVERSITY OF MINNESOTA
Driven to Discover™

For each of the following cases (22), two CBCT images (coronal and axial slices from the same patient) are provided showing a maxillary sinus or airway finding. Crosshairs and/or yellow circles identify the finding in question.

Please respond by selecting one of the multiple choice options.
Please add comments in the text box as necessary - this is optional.



Adenoid hypertrophy



Based on the representation of this finding, would you recommend the dentist to:

- Do nothing - inform patient of the finding, but there is no need for workup or referral
- Ask additional questions regarding sinonasal symptoms, and refer to primary care provider/physician or otolaryngologist only if positive for symptoms
- Immediately refer to primary care provider/physician
- Immediately refer to otolaryngologist

Comments:

<<

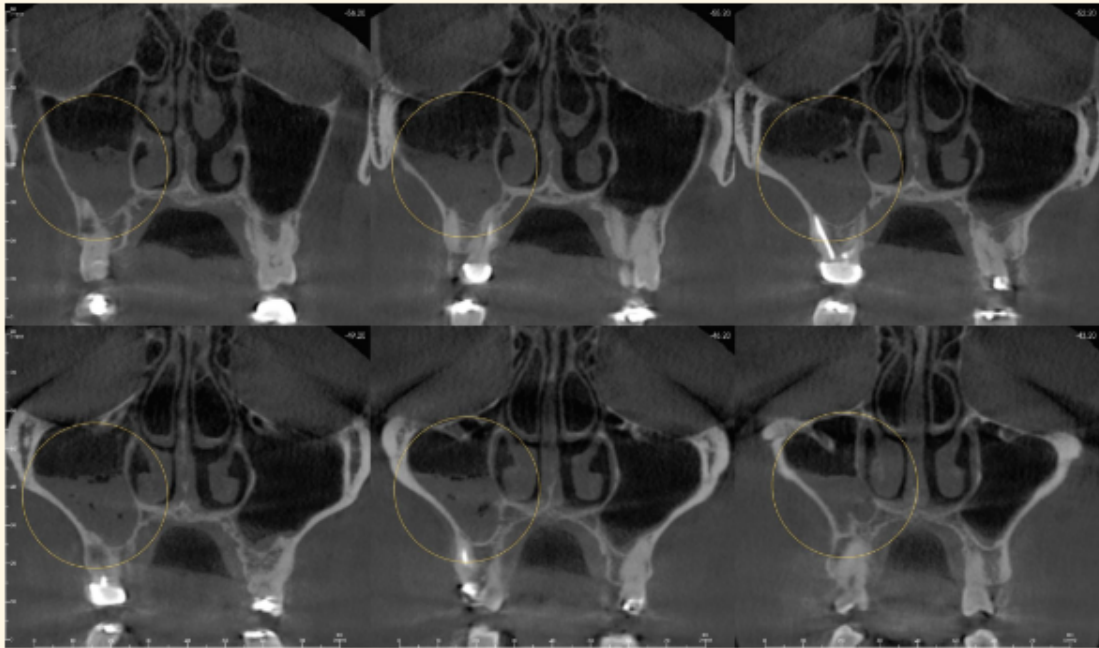
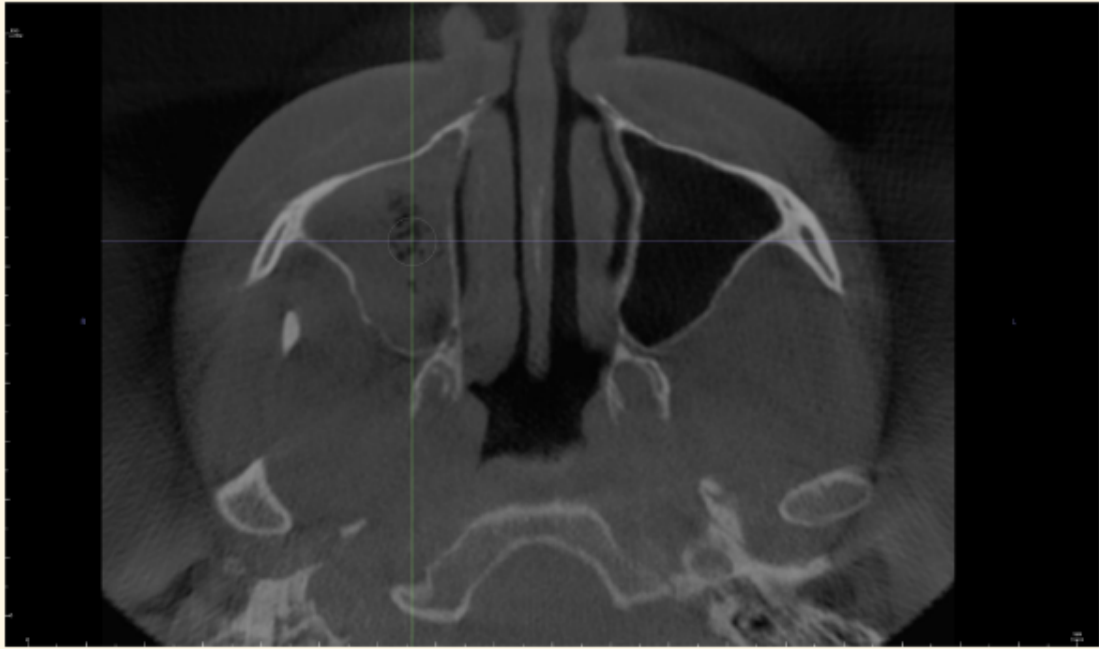
>>

ADENOID HYPERTROPHY

Do nothing – inform patient of the finding, but no need for workup or referral	19.4%
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	0.0%
Immediately refer to primary care provider/physician	48.4%
Immediately refer to otolaryngologist	29.0%

Comments: “again, not immediate but good to have ENT see for clinical correlation; if adult, why adenoids? Allergies? HIV? Should be answered by ENT”
“large adenoid pad”

Air-fluid level #1



Based on the representation of this finding, would you recommend the dentist to:

- Do nothing - inform patient of the finding, but there is no need for workup or referral
- Ask additional questions regarding sinonasal symptoms, and refer to primary care provider/physician or otolaryngologist only if positive for symptoms
- Immediately refer to primary care provider/physician
- Immediately refer to otolaryngologist

Comments:

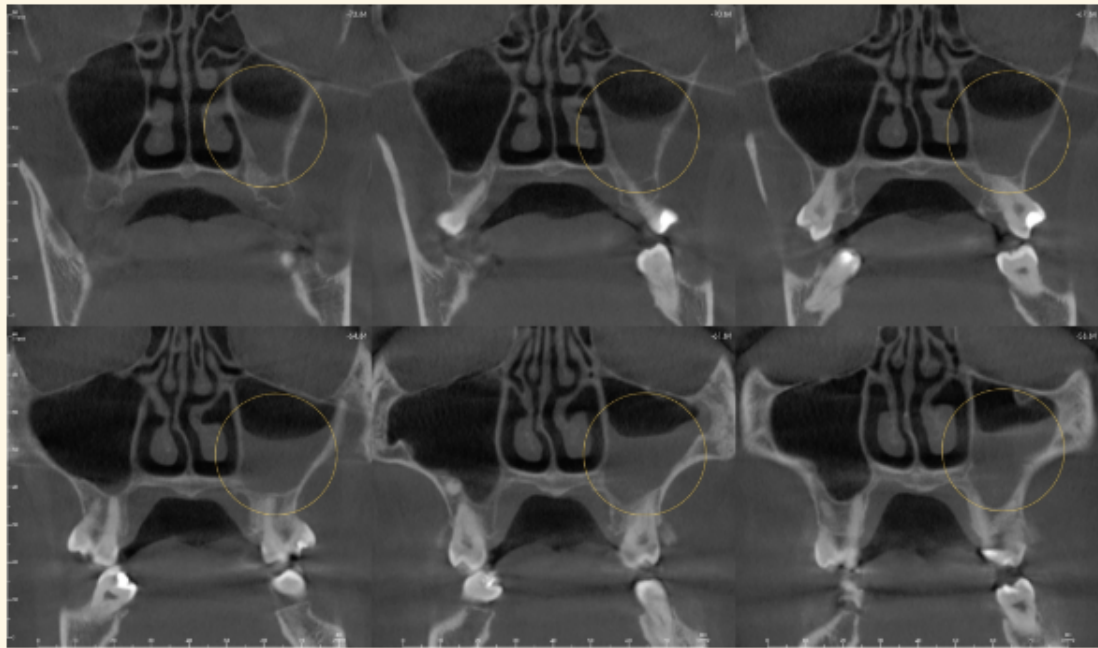
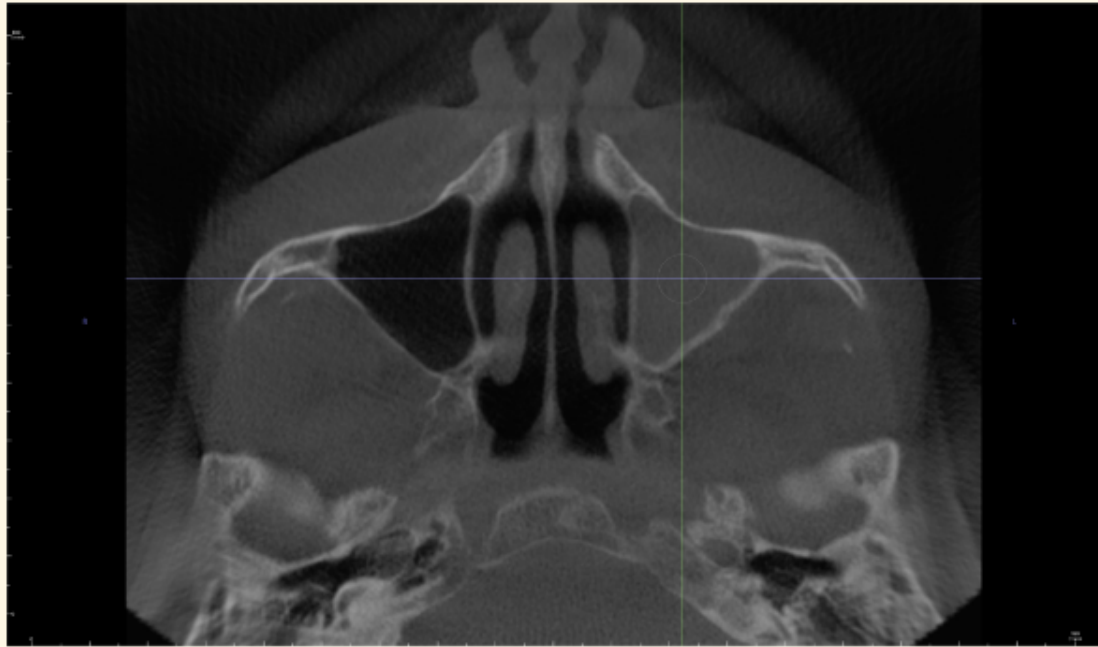


AIR-FLUID LEVEL #1

Do nothing – inform patient of the finding, but no need for workup or referral	0.0%
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	41.9%
Immediately refer to primary care provider/physician	22.6%
Immediately refer to otolaryngologist	35.5%

Comments: “not urgent”
 “sinusitis with concha bullosa”

Air-fluid level #2



Based on the representation of this finding, would you recommend the dentist to:

- Do nothing - inform patient of the finding, but there is no need for workup or referral
- Ask additional questions regarding sinonasal symptoms, and refer to primary care provider/physician or otolaryngologist only if positive for symptoms
- Immediately refer to primary care provider/physician
- Immediately refer to otolaryngologist

Comments:

<<
>>

AIR-FLUID LEVEL #2

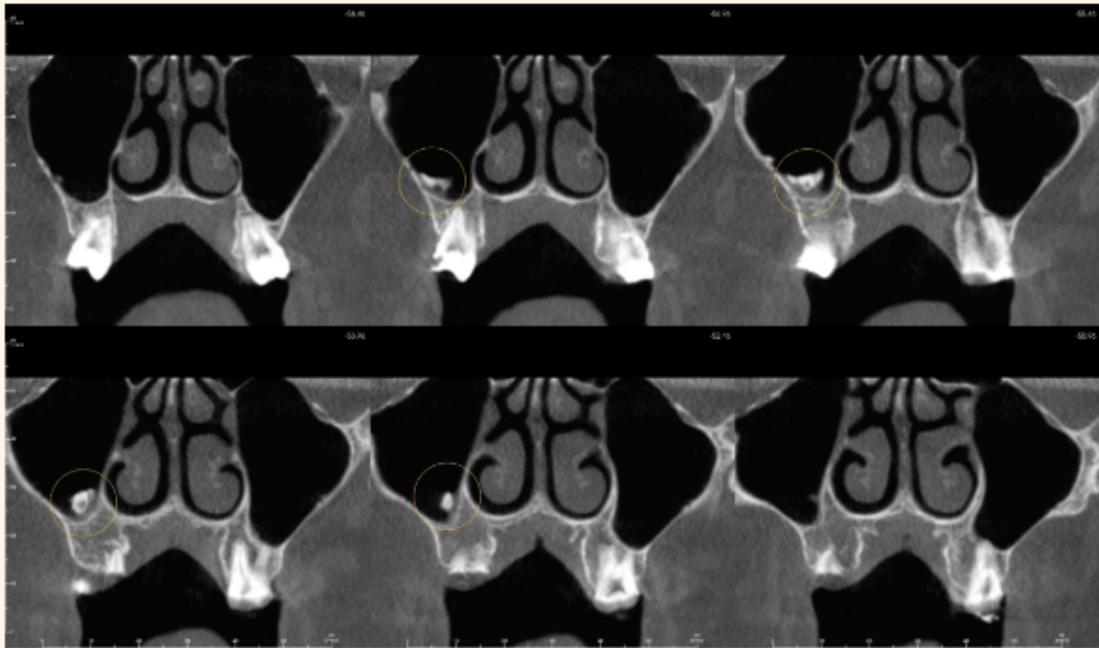
Do nothing – inform patient of the finding, but no need for workup or referral	0.0%
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	59.4%
Immediately refer to primary care provider/physician	18.8%
Immediately refer to otolaryngologist	21.9%

Comments: “refer to primary doctor any time there are abnormal CT scan findings, especially if unilateral”

Antrolith/foreign body



UNIVERSITY OF MINNESOTA
Driven to Discover™



Based on the representation of this finding, would you recommend the dentist to:

- Do nothing - inform patient of the finding, but there is no need for workup or referral
- Ask additional questions regarding sinonasal symptoms, and refer to primary care provider/physician or otolaryngologist only if positive for symptoms
- Immediately refer to primary care provider/physician
- Immediately refer to otolaryngologist

Comments:

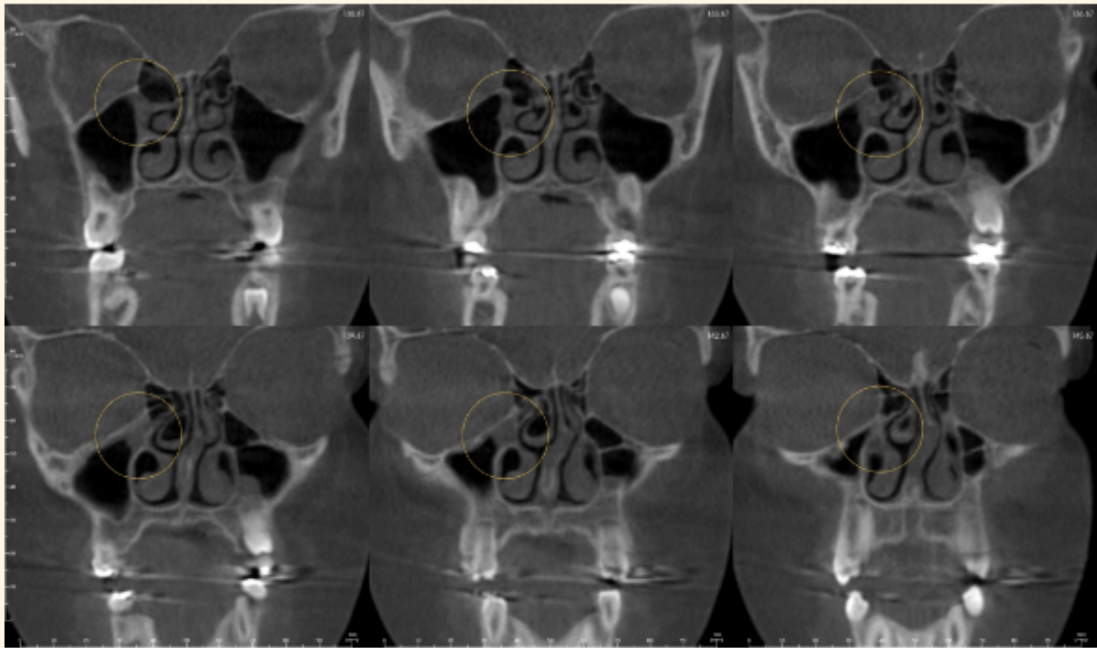
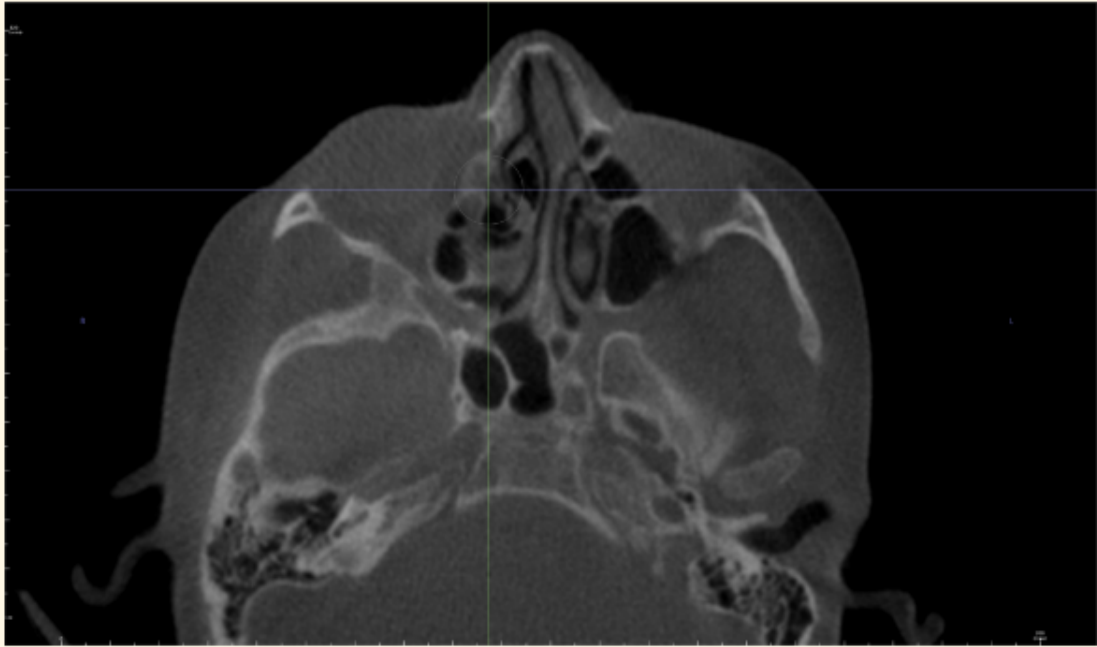
<<
>>

ANTROLITH/FOREIGN BODY

Do nothing – inform patient of the finding, but no need for workup or referral	38.2%
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	35.3%
Immediately refer to primary care provider/physician	2.9%
Immediately refer to otolaryngologist	23.5%

Comments: “refer if not a dental problem”
“likely benign, would recommend to refer to primary care but not an urgent consult”

Blocked ostiomeatal unit



Based on the representation of this finding, would you recommend the dentist to:

- Do nothing - inform patient of the finding, but there is no need for workup or referral
- Ask additional questions regarding sinonasal symptoms, and refer to primary care provider/physician or otolaryngologist only if positive for symptoms
- Immediately refer to primary care provider/physician
- Immediately refer to otolaryngologist

Comments:



BLOCKED OSTIOMEATAL UNIT

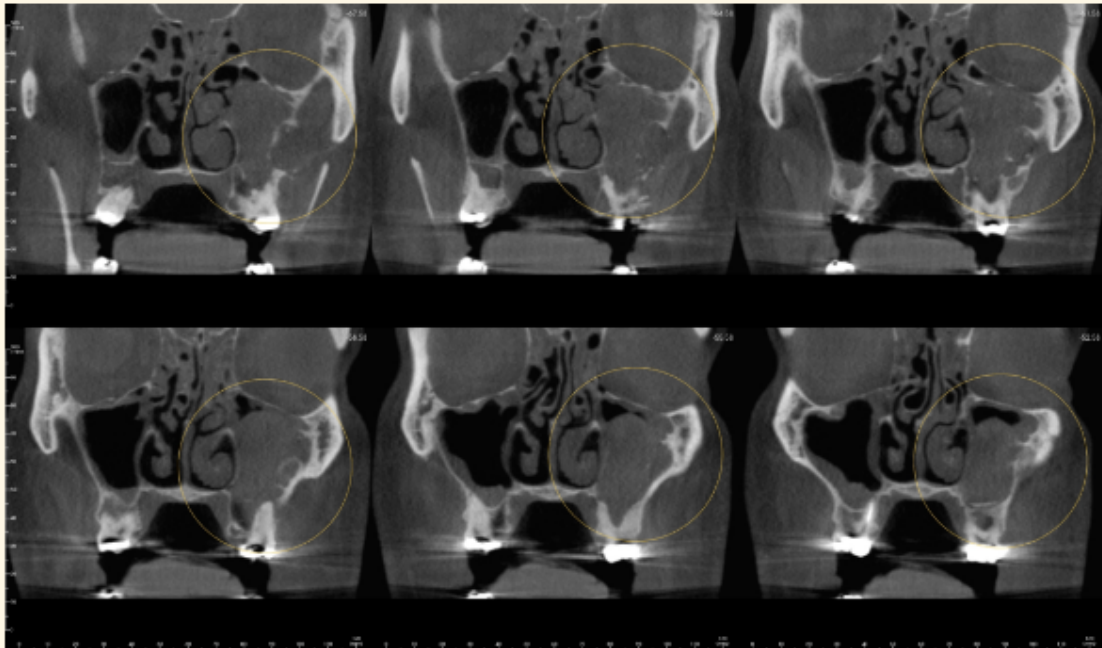
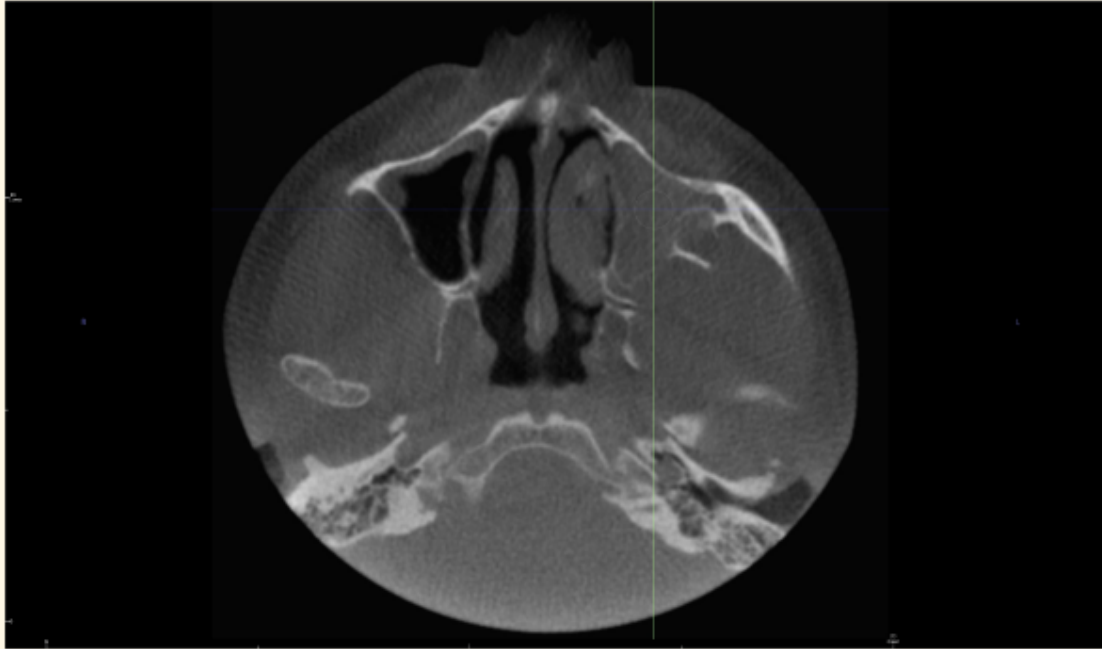
Do nothing – inform patient of the finding, but no need for workup or referral	5.9%
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	64.7%
Immediately refer to primary care provider/physician	0.0%
Immediately refer to otolaryngologist	29.4%

Comments:

Bone erosion of sinus wall



UNIVERSITY OF MINNESOTA
Driven to Discover™



Based on the representation of this finding, would you recommend the dentist to:

- Do nothing - inform patient of the finding, but there is no need for workup or referral
- Ask additional questions regarding sinonasal symptoms, and refer to primary care provider/physician or otolaryngologist only if positive for symptoms
- Immediately refer to primary care provider/physician
- Immediately refer to otolaryngologist

Comments:

<<
>>

BONE EROSION OF SINUS WALL

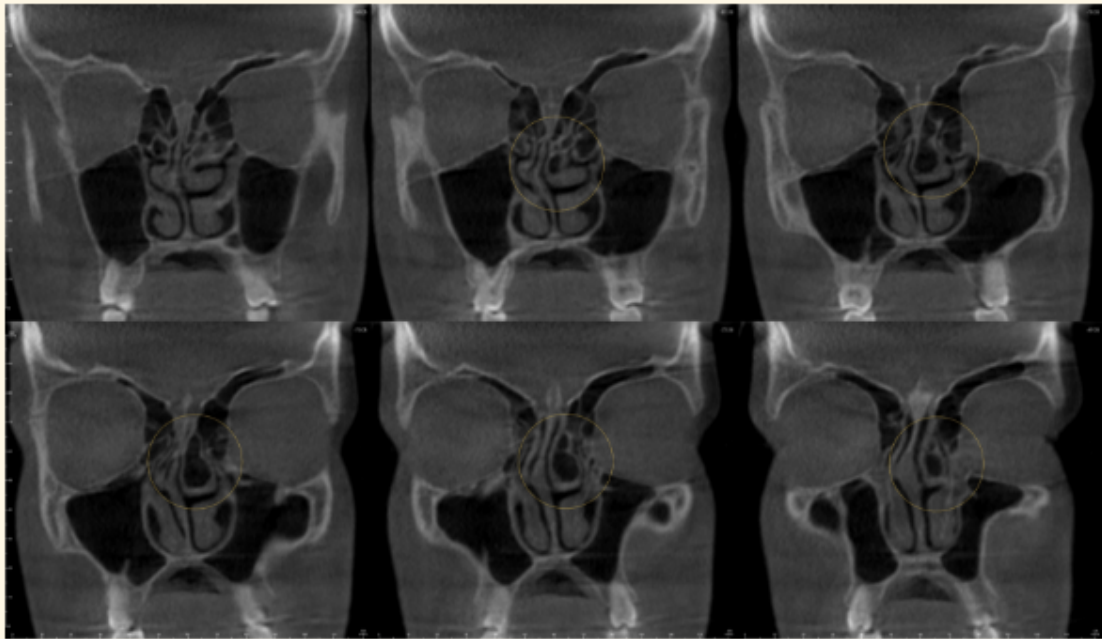
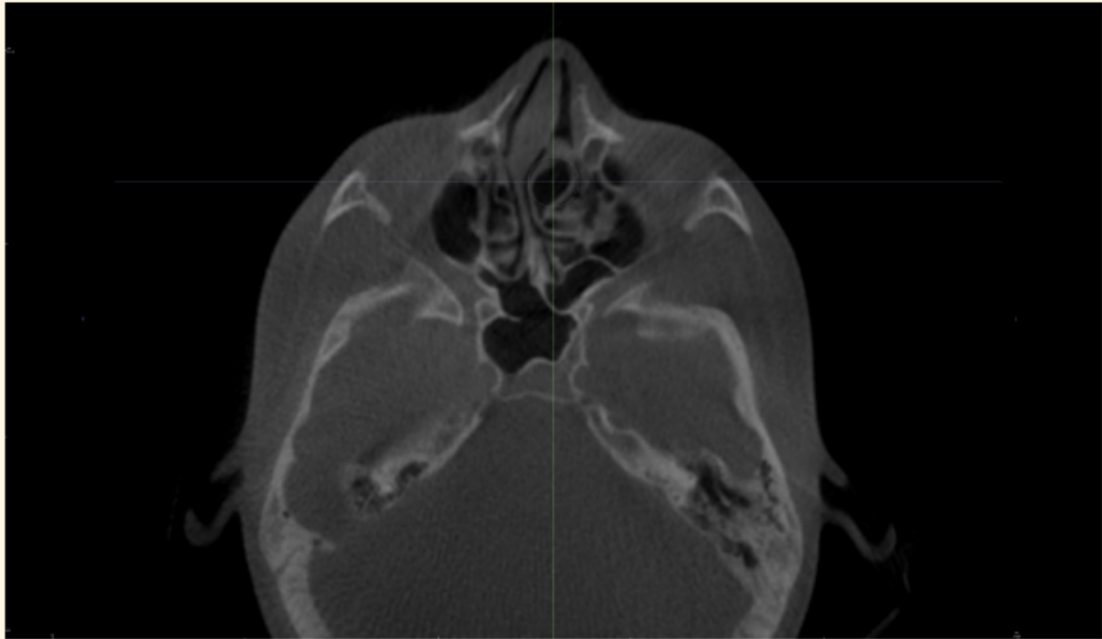
Do nothing – inform patient of the finding, but no need for workup or referral	0.0%
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	3.0%
Immediately refer to primary care provider/physician	0.0%
Immediately refer to otolaryngologist	97.0%

Comments: “may or may not require septoplasty depending on symptoms”
 “but does the dentists know the right questions to ask; maybe for instance the patient has only unilateral headache (i.e. contact spur headache)”

Concha bullosa



UNIVERSITY OF MINNESOTA
Driven to Discover™



Based on the representation of this finding, would you recommend the dentist to:

- Do nothing - inform patient of the finding, but there is no need for workup or referral
- Ask additional questions regarding sinonasal symptoms, and refer to primary care provider/physician or otolaryngologist only if positive for symptoms
- Immediately refer to primary care provider/physician
- Immediately refer to otolaryngologist

Comments:

<<

>>

CONCHA BULLOSA

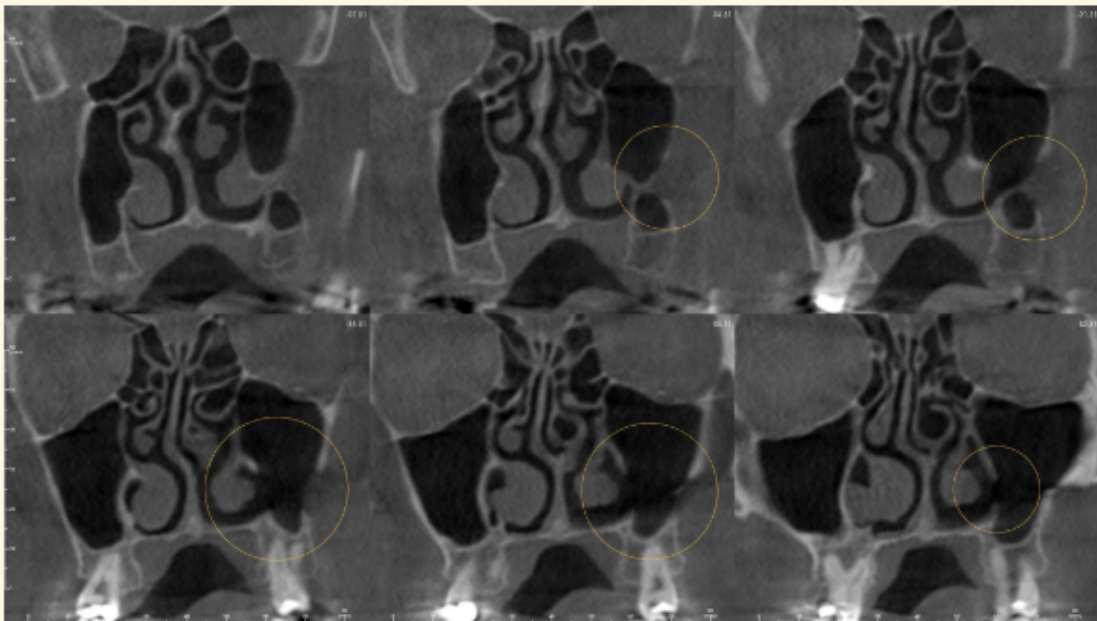
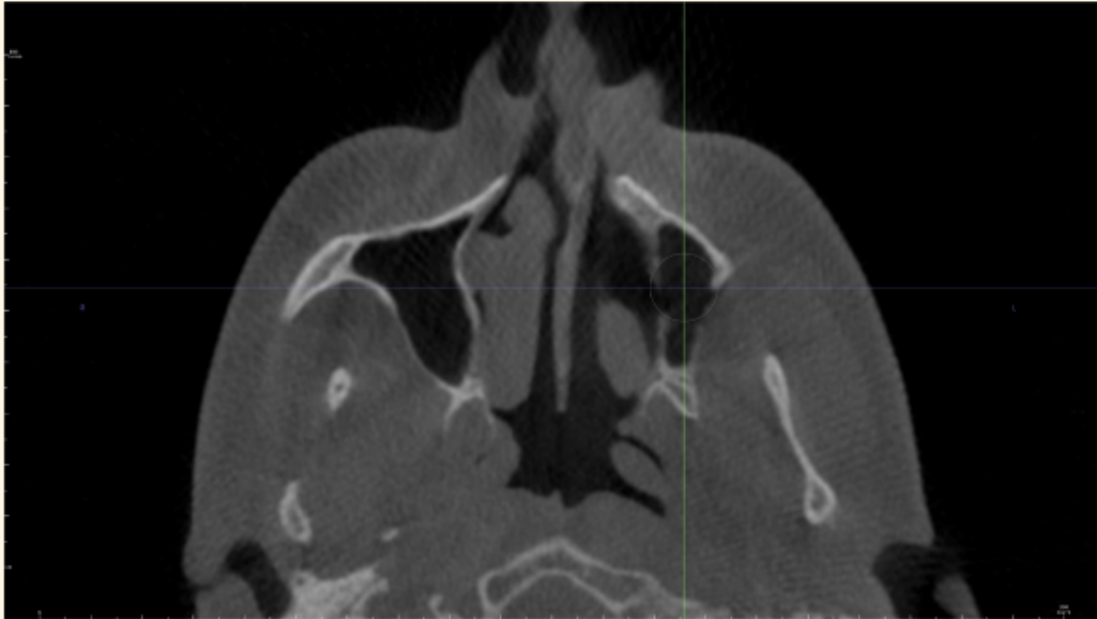
Do nothing – inform patient of the finding, but no need for workup or referral	30.0%
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	63.3%
Immediately refer to primary care provider/physician	0.0%
Immediately refer to otolaryngologist	6.7%

Comments:

Disrupted sinus wall



UNIVERSITY OF MINNESOTA
Driven to Discover™



Based on the representation of this finding, would you recommend the dentist to:

- Do nothing - inform patient of the finding, but there is no need for workup or referral
- Ask additional questions regarding sinonasal symptoms, and refer to primary care provider/physician or otolaryngologist only if positive for symptoms
- Immediately refer to primary care provider/physician
- Immediately refer to otolaryngologist

Comments:

<<

>>

DISRUPTED SINUS WALL

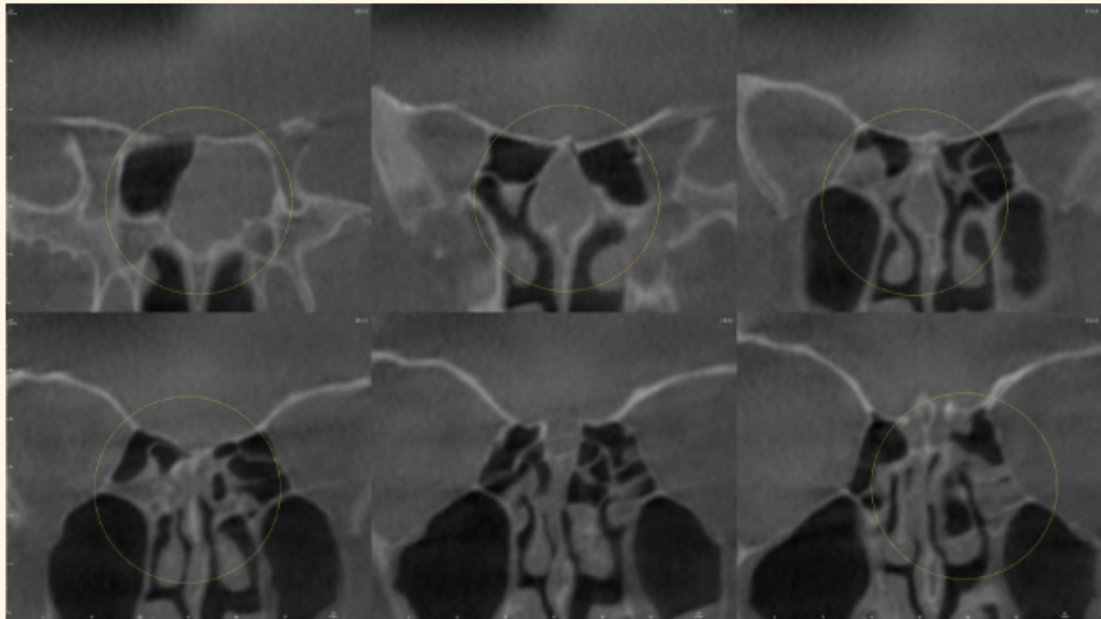
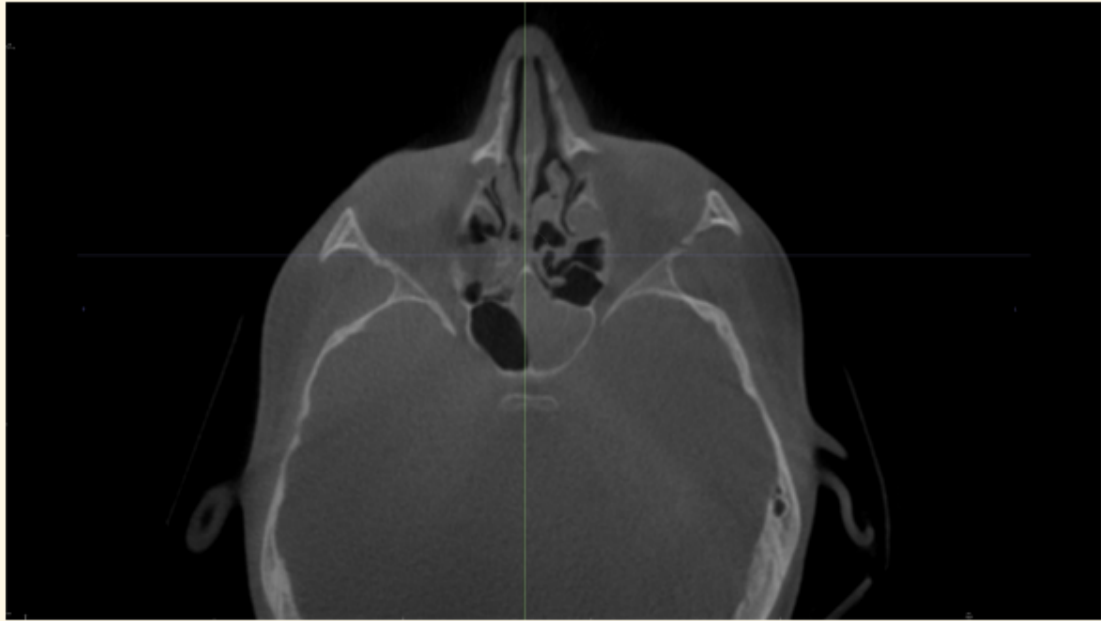
Do nothing – inform patient of the finding, but no need for workup or referral	33.3%
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	50.0%
Immediately refer to primary care provider/physician	0.0%
Immediately refer to otolaryngologist	16.7%

Comments: “appears post-op finding without active sinus disease”
“if not history of sinus surgery”
“ask about prior surgery or injury; refer if no prior history”

Ethmoid sinusitis



UNIVERSITY OF MINNESOTA
Driven to Discover™



Based on the representation of this finding, would you recommend the dentist to:

- Do nothing - inform patient of the finding, but there is no need for workup or referral
- Ask additional questions regarding sinonasal symptoms, and refer to primary care provider/physician or otolaryngologist only if positive for symptoms
- Immediately refer to primary care provider/physician
- Immediately refer to otolaryngologist

Comments:



ETHMOID SINUSITIS

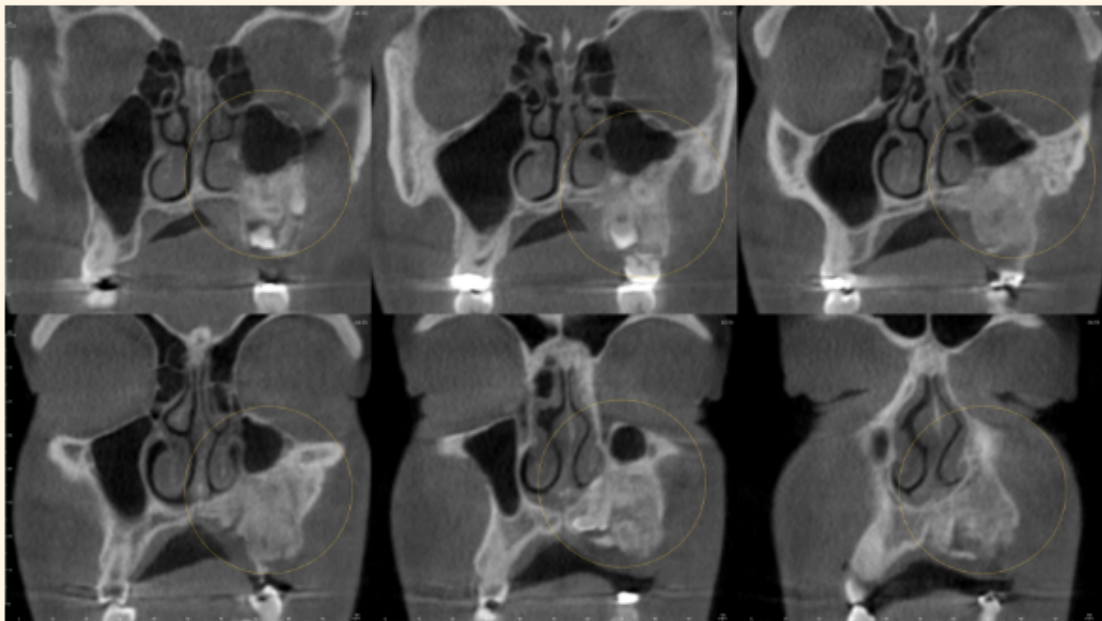
Do nothing – inform patient of the finding, but no need for workup or referral	0.0%
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	10.0%
Immediately refer to primary care provider/physician	0.0%
Immediately refer to otolaryngologist	90.0%

Comments:

Fibrous dysplasia



UNIVERSITY OF MINNESOTA
Driven to Discover™



Based on the representation of this finding, would you recommend the dentist to:

- Do nothing - inform patient of the finding, but there is no need for workup or referral
- Ask additional questions regarding sinonasal symptoms, and refer to primary care provider/physician or otolaryngologist only if positive for symptoms
- Immediately refer to primary care provider/physician
- Immediately refer to otolaryngologist

Comments:

<<

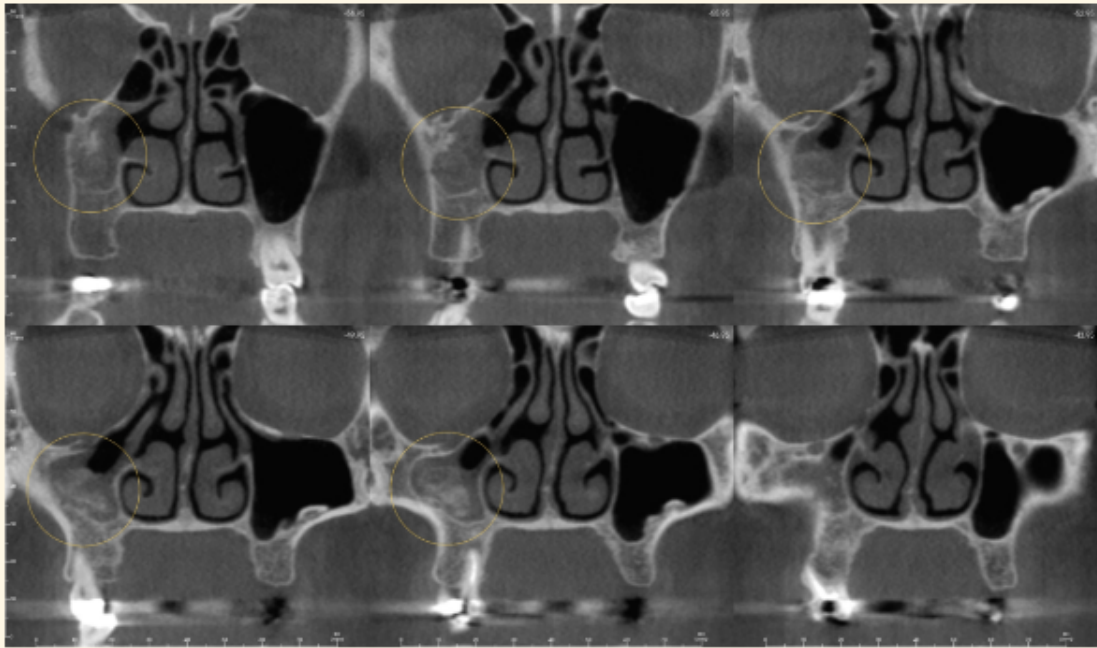
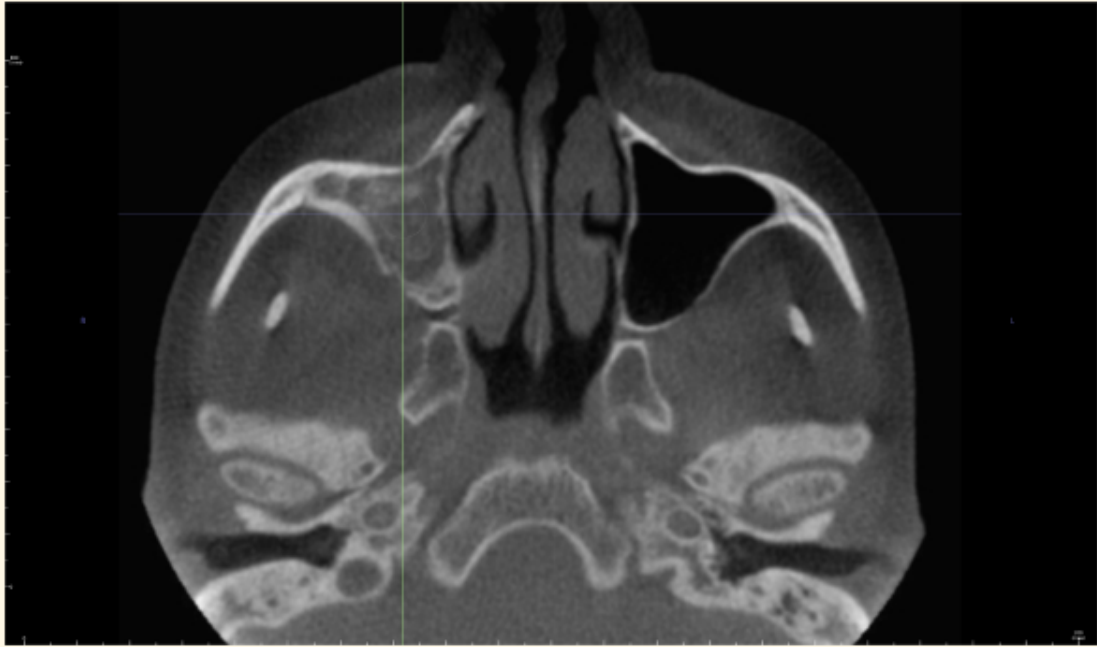
>>

FIBROUS DYSPLASIA

Do nothing – inform patient of the finding, but no need for workup or referral	0.0%
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	3.2%
Immediately refer to primary care provider/physician	3.2%
Immediately refer to otolaryngologist	93.6%

Comments: “referral not necessary if history of dental procedures/issues where this findings is an expected outcome”

Heterogeneous opacification of maxillary sinus #1



Based on the representation of this finding, would you recommend the dentist to:

- Do nothing - inform patient of the finding, but there is no need for workup or referral
- Ask additional questions regarding sinonasal symptoms, and refer to primary care provider/physician or otolaryngologist only if positive for symptoms
- Immediately refer to primary care provider/physician
- Immediately refer to otolaryngologist

Comments:



HETEROGENEOUS OPACIFICATION OF MAXILLARY SINUS #1

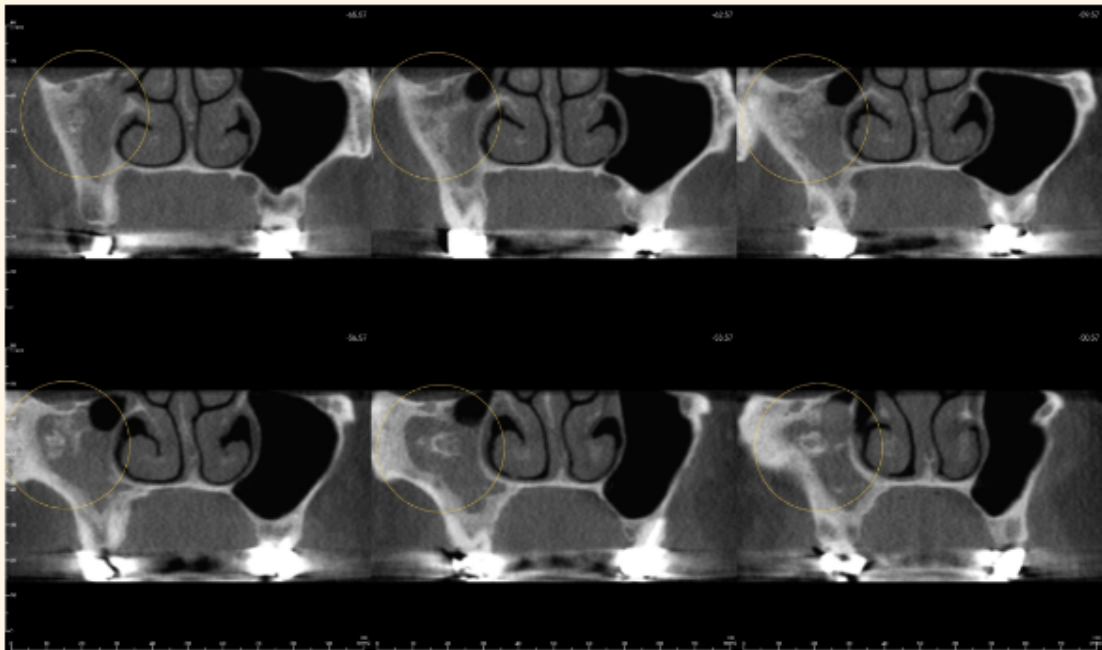
Do nothing – inform patient of the finding, but no need for workup or referral	0.0%
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	9.4%
Immediately refer to primary care provider/physician	3.1%
Immediately refer to otolaryngologist	87.5%

Comments: “not an urgent consults”
“calcification suspicious for fungus” “again, probably nothing to do about it but better explained by ENT; not sure there needs to be an ‘immediate referral’”
“looks like fungus”

Heterogeneous opacification of maxillary sinus #2



UNIVERSITY OF MINNESOTA
Driven to Discover™



Based on the representation of this finding, would you recommend the dentist to:

- Do nothing - inform patient of the finding, but there is no need for workup or referral
- Ask additional questions regarding sinonasal symptoms, and refer to primary care provider/physician or otolaryngologist only if positive for symptoms
- Immediately refer to primary care provider/physician
- Immediately refer to otolaryngologist

Comments:

<<

>>

HETEROGENEOUS OPACIFICATION OF MAXILLARY SINUS #2

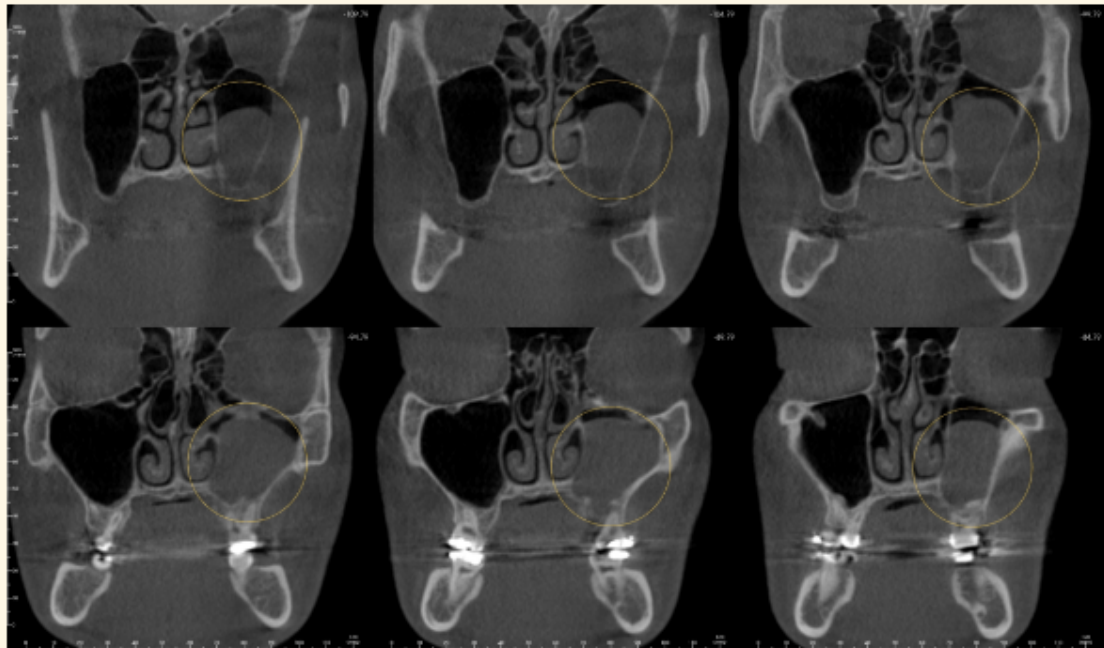
Do nothing – inform patient of the finding, but no need for workup or referral	0.0%
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	6.5%
Immediately refer to primary care provider/physician	0.0%
Immediately refer to otolaryngologist	93.6%

Comments:

Large mucocele/cystic lesion



UNIVERSITY OF MINNESOTA
Driven to Discover™



Based on the representation of this finding, would you recommend the dentist to:

- Do nothing - inform patient of the finding, but there is no need for workup or referral
- Ask additional questions regarding sinonasal symptoms, and refer to primary care provider/physician or otolaryngologist only if positive for symptoms
- Immediately refer to primary care provider/physician
- Immediately refer to otolaryngologist

Comments:

<<

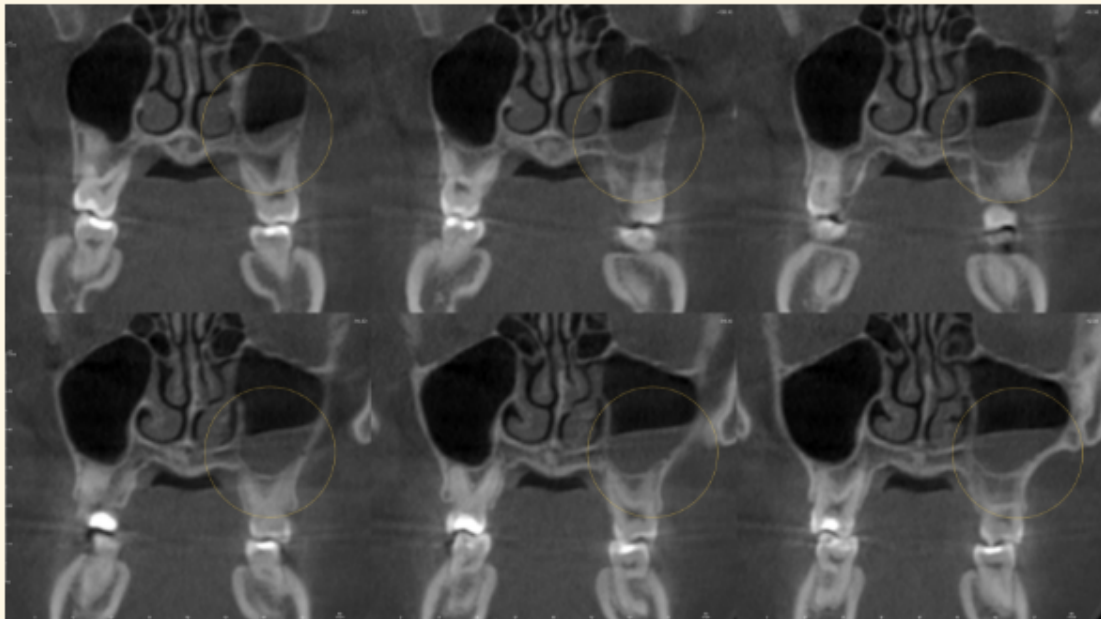
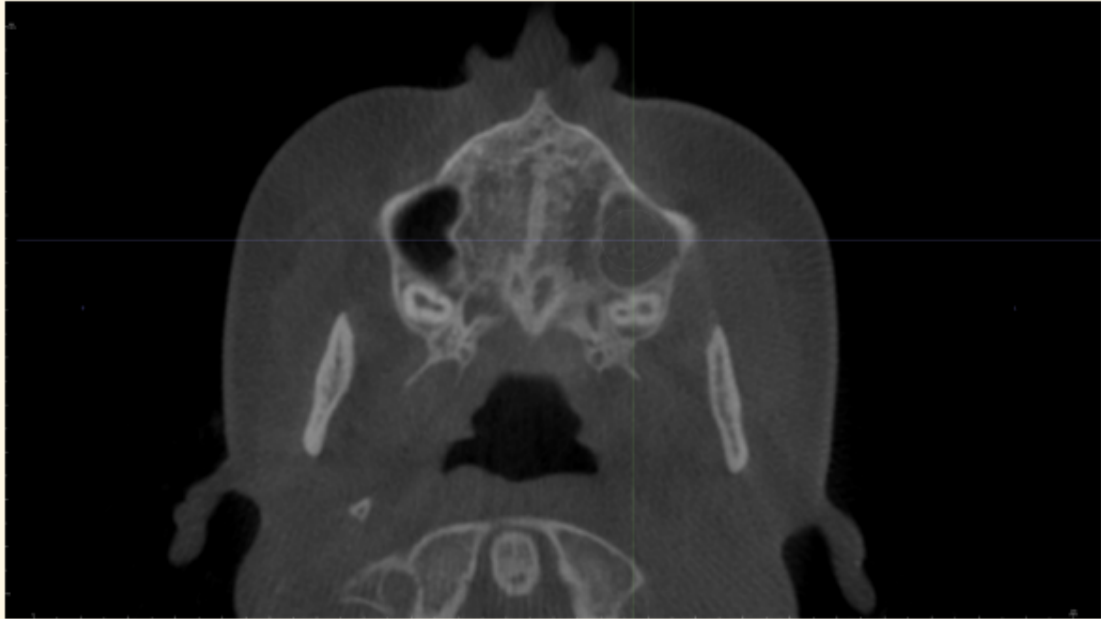
>>

LARGE MUCOCELE/CYSTIC LESION

Do nothing – inform patient of the finding, but no need for workup or referral	0.0%
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	57.6%
Immediately refer to primary care provider/physician	6.1%
Immediately refer to otolaryngologist	36.4%

Comments: “doesn’t need to be immediate, not urgent consult”
“probably asymptomatic but good to refer; dentist shouldn’t have to take on responsibility of explaining an incidental finding especially if later on it became an issue”

Mucosal thickening of sinus floor



Based on the representation of this finding, would you recommend the dentist to:

- Do nothing - inform patient of the finding, but there is no need for workup or referral
- Ask additional questions regarding sinonasal symptoms, and refer to primary care provider/physician or otolaryngologist only if positive for symptoms
- Immediately refer to primary care provider/physician
- Immediately refer to otolaryngologist

Comments:

<<
>>

MUCOSAL THICKENING OF SINUS FLOOR

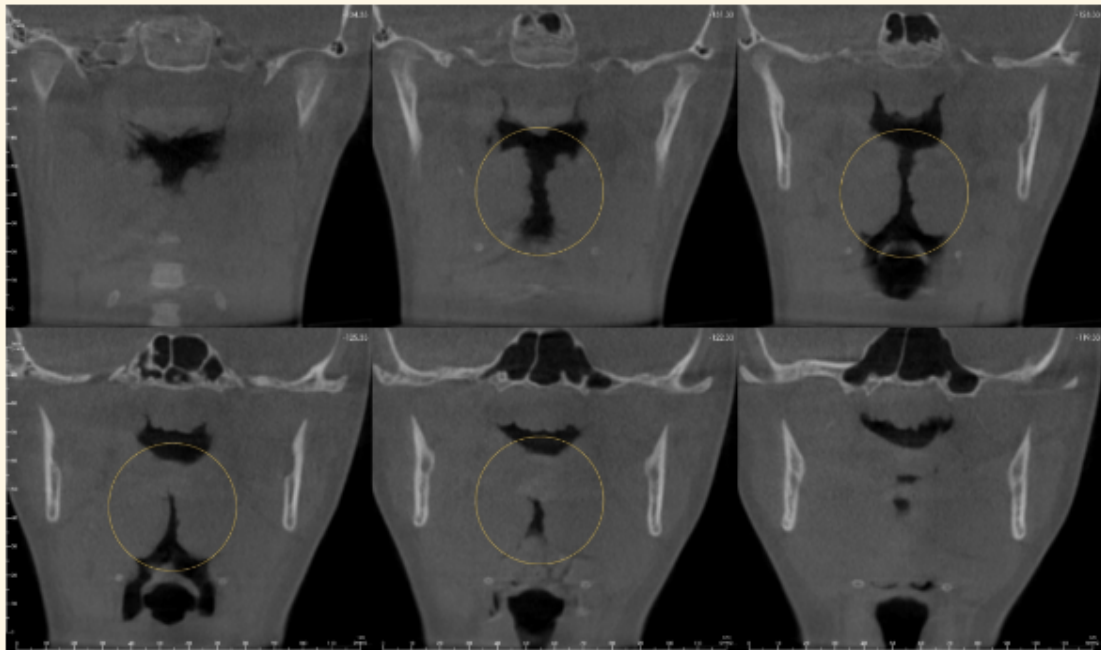
Do nothing – inform patient of the finding, but no need for workup or referral	0.0%
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	66.7%
Immediately refer to primary care provider/physician	15.2%
Immediately refer to otolaryngologist	18.2%

Comments: “likely acute sinusitis, any abnormal sinus CT findings should be referred to a medical doctor, but not urgently”

Palatine tonsil hypertrophy



UNIVERSITY OF MINNESOTA
Driven to Discover™



Based on the representation of this finding, would you recommend the dentist to:

- Do nothing - inform patient of the finding, but there is no need for workup or referral
- Ask additional questions regarding sinonasal symptoms, and refer to primary care provider/physician or otolaryngologist only if positive for symptoms
- Immediately refer to primary care provider/physician
- Immediately refer to otolaryngologist

Comments:

<<

>>

PALATINE TONSIL HYPERTROPHY

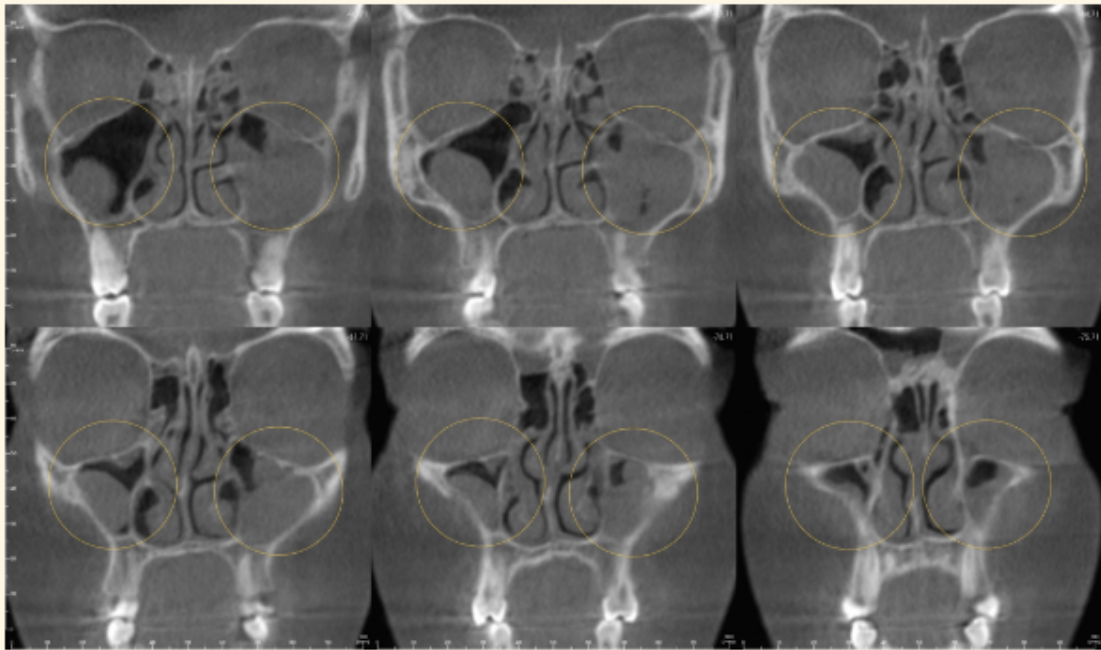
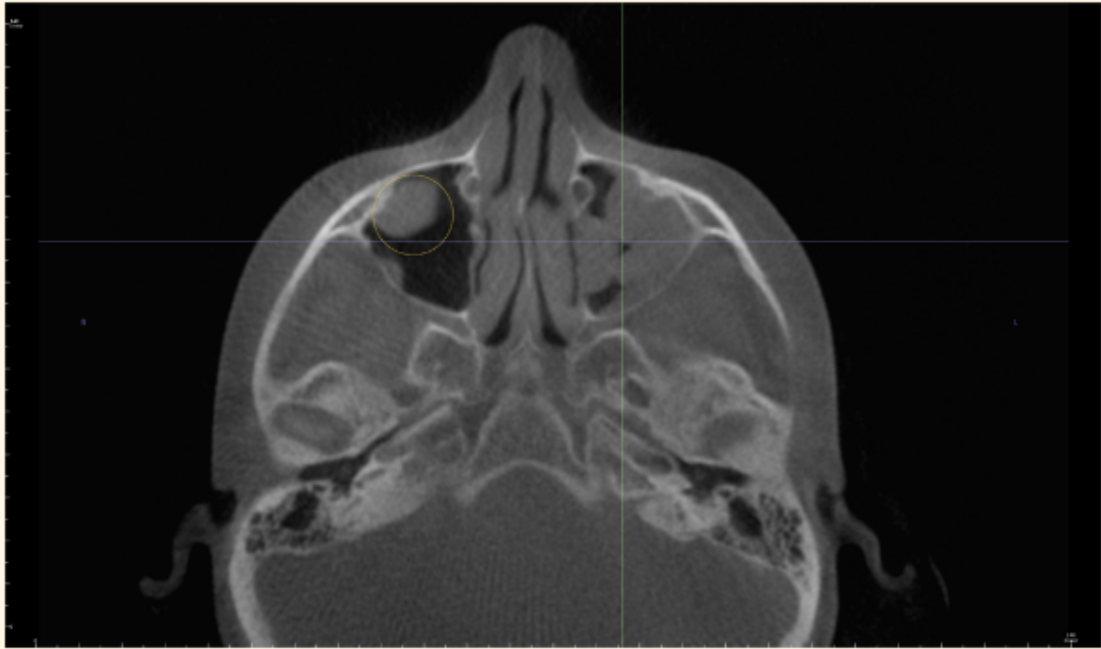
Do nothing – inform patient of the finding, but no need for workup or referral	6.5%
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	54.8%
Immediately refer to primary care provider/physician	3.2%
Immediately refer to otolaryngologist	54.8%

Comments: “this could be palatine tonsil hypertrophy as well”
“not sino nasal symptoms but ask about upper respiratory symptoms like snoring”
“same comments as the one regarding adenoids”

Polypoid mucosal thickening



UNIVERSITY OF MINNESOTA
Driven to Discover™



Based on the representation of this finding, would you recommend the dentist to:

- Do nothing - inform patient of the finding, but there is no need for workup or referral
- Ask additional questions regarding sinonasal symptoms, and refer to primary care provider/physician or otolaryngologist only if positive for symptoms
- Immediately refer to primary care provider/physician
- Immediately refer to otolaryngologist

Comments:

<<

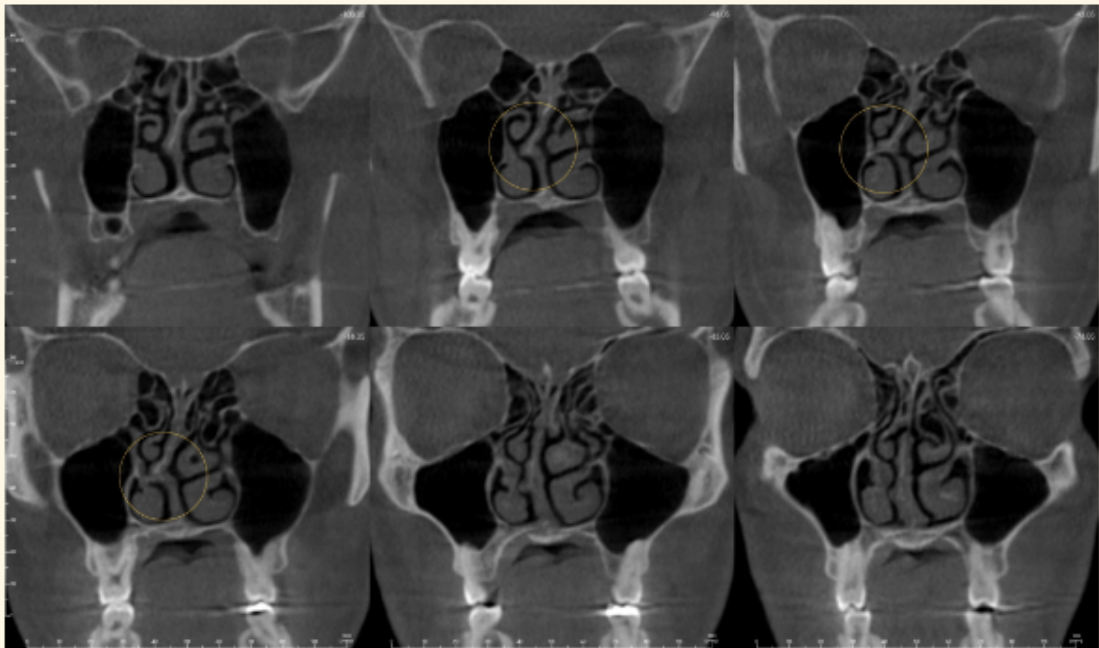
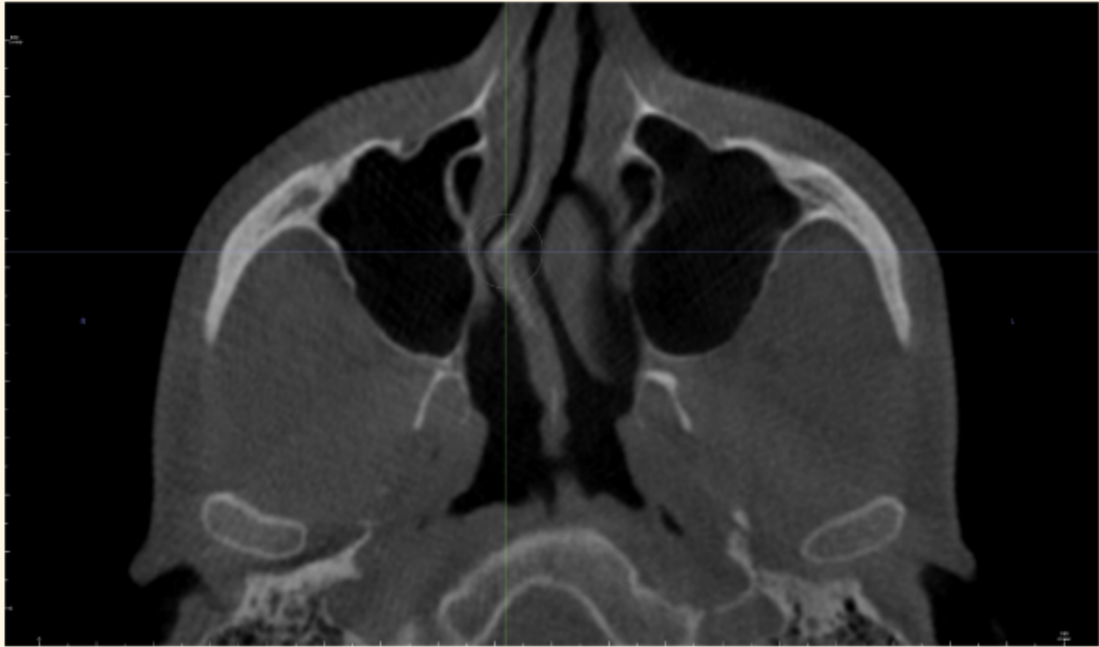
>>

POLYPOID MUCOSAL THICKENING

Do nothing – inform patient of the finding, but no need for workup or referral	0.0%
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	3.2%
Immediately refer to primary care provider/physician	41.9%
Immediately refer to otolaryngologist	54.8%

Comments: “may be asymptomatic but could have chronic condition”

Septal deviation/septal spur



Based on the representation of this finding, would you recommend the dentist to:

- Do nothing - inform patient of the finding, but there is no need for workup or referral
- Ask additional questions regarding sinonasal symptoms, and refer to primary care provider/physician or otolaryngologist only if positive for symptoms
- Immediately refer to primary care provider/physician
- Immediately refer to otolaryngologist

Comments:



SEPTAL DEVIATION/SEPTAL SPUR

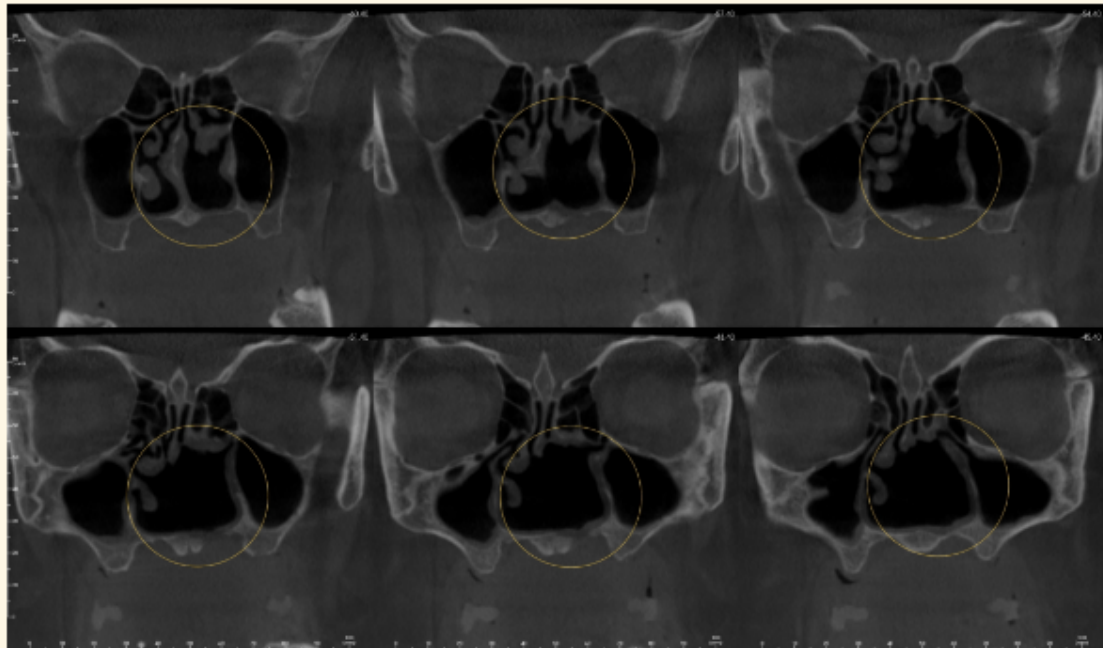
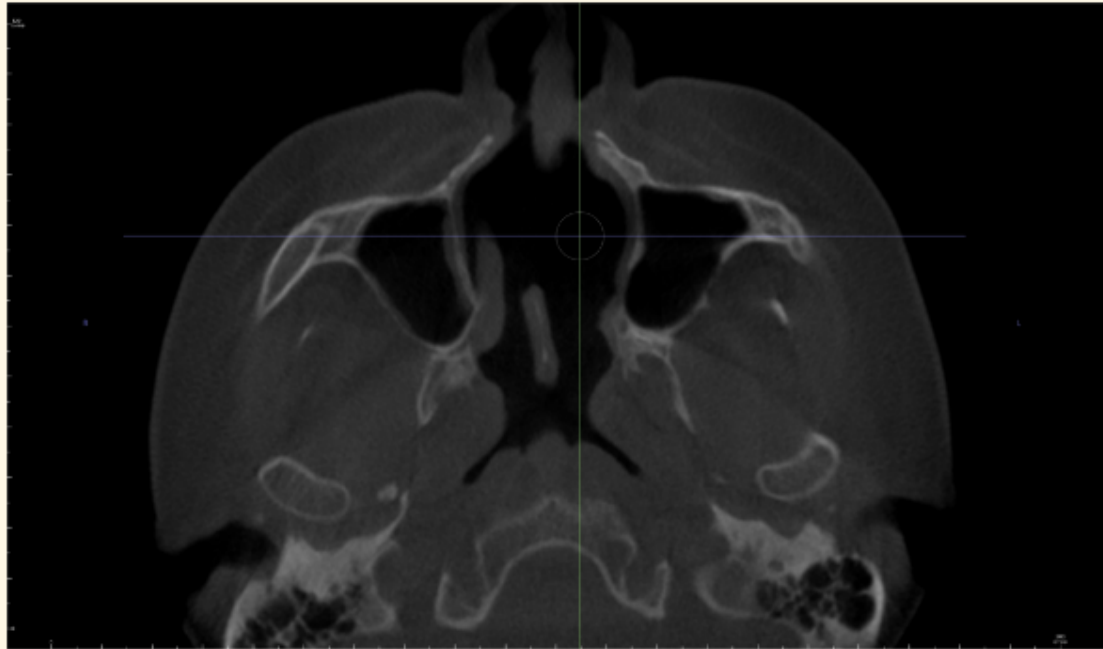
Do nothing – inform patient of the finding, but no need for workup or referral	9.1%
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	81.8%
Immediately refer to primary care provider/physician	3.0%
Immediately refer to otolaryngologist	6.1%

Comments:

Septal perforation



UNIVERSITY OF MINNESOTA
Driven to Discover™



Based on the representation of this finding, would you recommend the dentist to:

- Do nothing - inform patient of the finding, but there is no need for workup or referral
- Ask additional questions regarding sinonasal symptoms, and refer to primary care provider/physician or otolaryngologist only if positive for symptoms
- Immediately refer to primary care provider/physician
- Immediately refer to otolaryngologist

Comments:

<<
>>

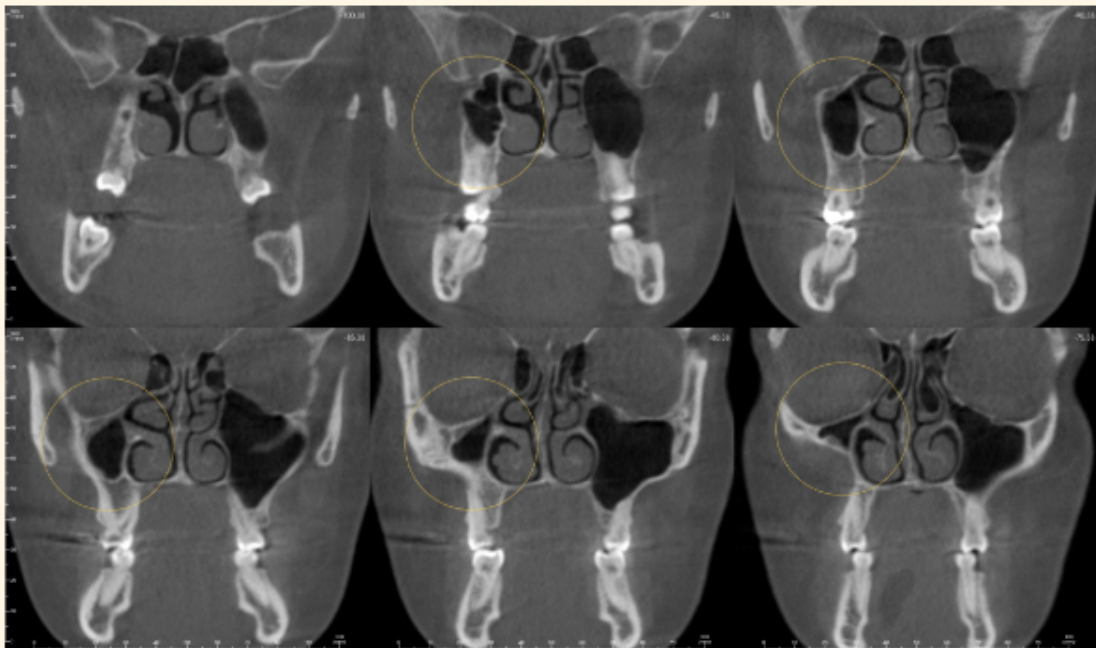
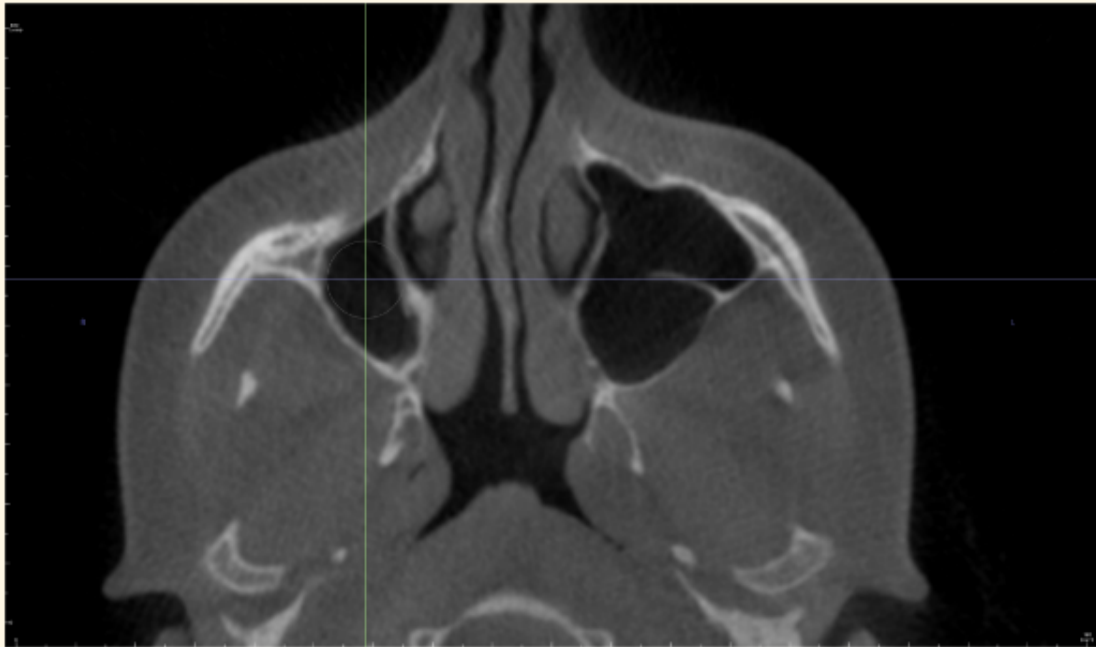
SEPTAL PERFORATION

Do nothing – inform patient of the finding, but no need for workup or referral	15.6%
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	28.1%
Immediately refer to primary care provider/physician	6.3%
Immediately refer to otolaryngologist	50.0%

Comments:

- “findings may be post-operative; referral if not already under the care of an ENT”
- “I need more information; is this post-surgical, post-traumatic, post-infectious? Is the patient already established with an ENT?”
- “if no prior surgery”
- “this looks like previous surgery”

Sinus hypoplasia



Based on the representation of this finding, would you recommend the dentist to:

- Do nothing - inform patient of the finding, but there is no need for workup or referral
- Ask additional questions regarding sinonasal symptoms, and refer to primary care provider/physician or otolaryngologist only if positive for symptoms
- Immediately refer to primary care provider/physician
- Immediately refer to otolaryngologist

Comments:



SINUS HYPOPLASIA

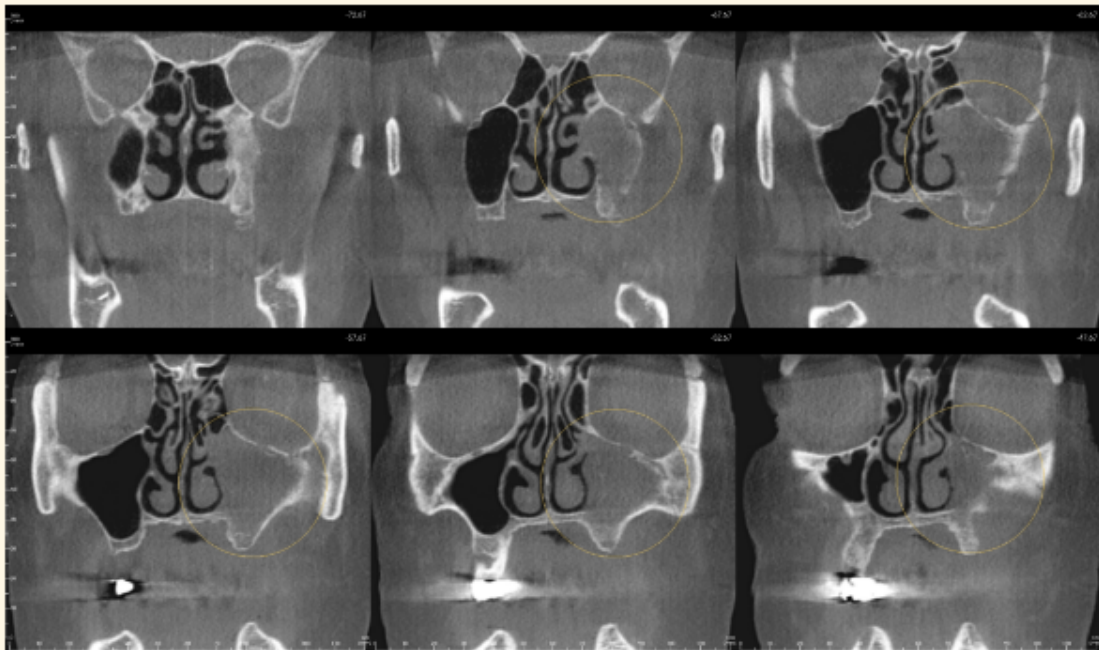
Do nothing – inform patient of the finding, but no need for workup or referral	29.4%
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	58.8%
Immediately refer to primary care provider/physician	0.0%
Immediately refer to otolaryngologist	11.8%

Comments: “may have only eye symptoms – diplopia would prompt referral to otolaryngologist”
“may also have physical features c/w silent sinus syndrome”

Sinus opacification with bone erosion



UNIVERSITY OF MINNESOTA
Driven to Discover™



Based on the representation of this finding, would you recommend the dentist to:

- Do nothing - inform patient of the finding, but there is no need for workup or referral
- Ask additional questions regarding sinonasal symptoms, and refer to primary care provider/physician or otolaryngologist only if positive for symptoms
- Immediately refer to primary care provider/physician
- Immediately refer to otolaryngologist

Comments:

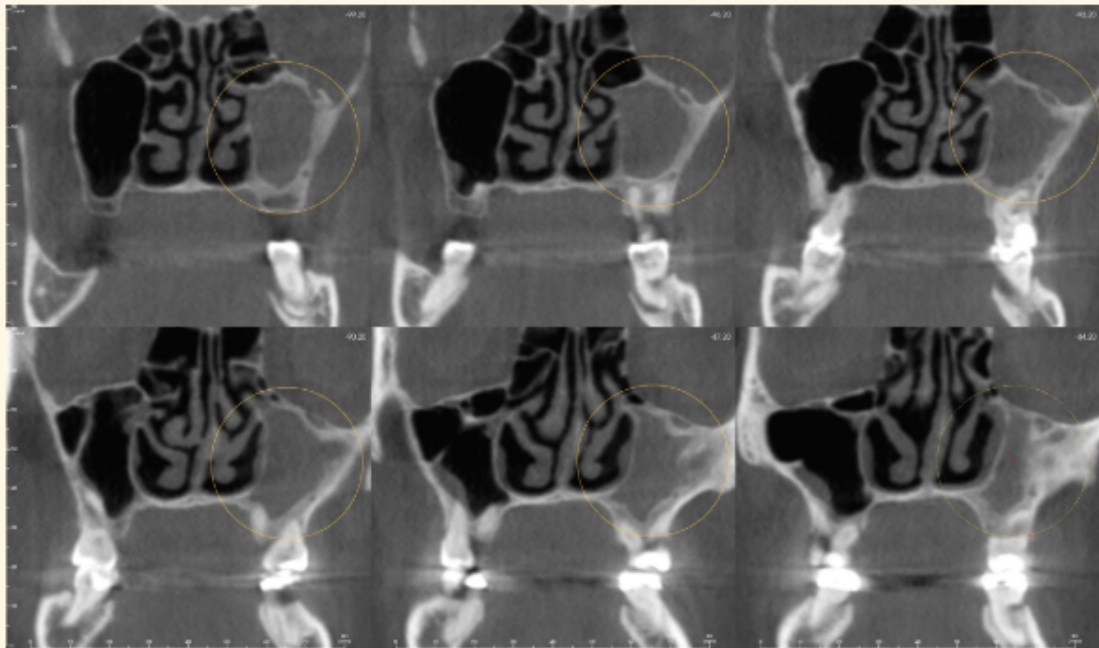
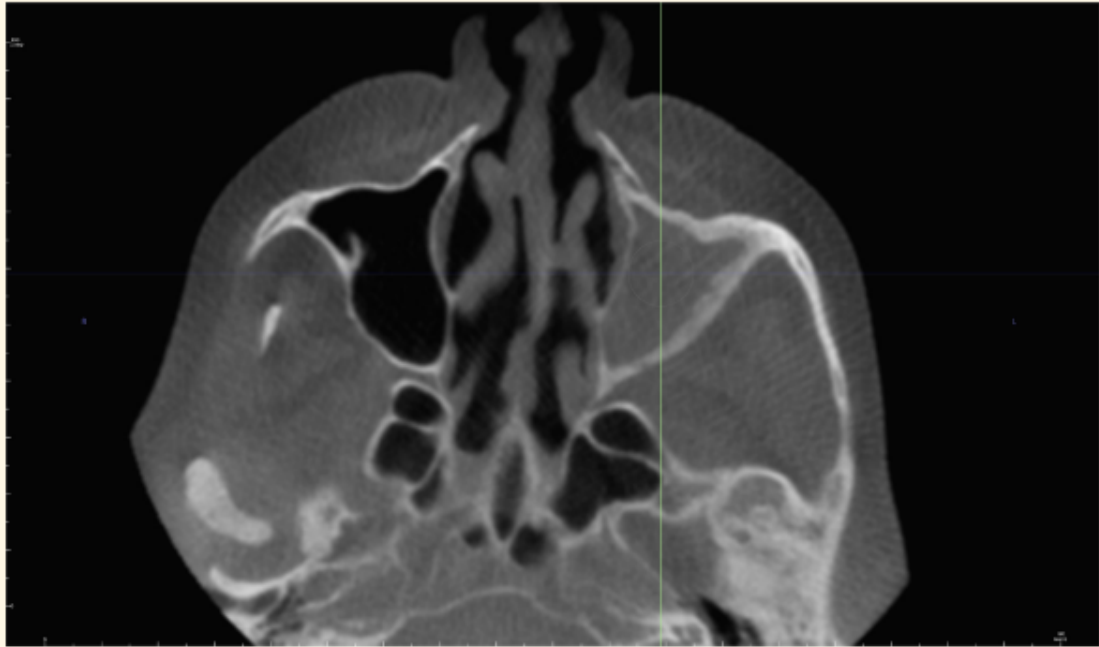


SINUS OPACIFICATION WITH BONE EROSION

Do nothing – inform patient of the finding, but no need for workup or referral	0.0%
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	0.0%
Immediately refer to primary care provider/physician	3.2%
Immediately refer to otolaryngologist	96.8%

Comments:

Sinus osteomyelitis



Based on the representation of this finding, would you recommend the dentist to:

- Do nothing - inform patient of the finding, but there is no need for workup or referral
- Ask additional questions regarding sinonasal symptoms, and refer to primary care provider/physician or otolaryngologist only if positive for symptoms
- Immediately refer to primary care provider/physician
- Immediately refer to otolaryngologist

Comments:

<<

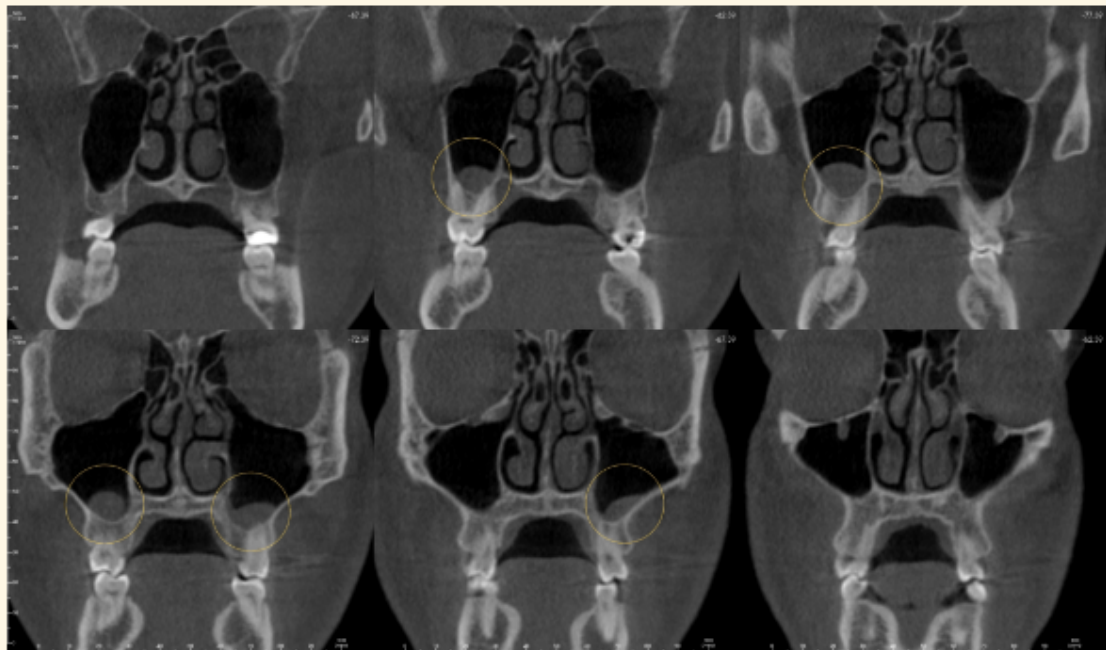
>>

SINUS OSTEOMYELITIS

Do nothing – inform patient of the finding, but no need for workup or referral	2.8%
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	16.7%
Immediately refer to primary care provider/physician	2.8%
Immediately refer to otolaryngologist	77.8%

Comments: “snot an urgent consult but appropriate to refer to ENT”

Small mucocele/cystic lesion



Based on the representation of this finding, would you recommend the dentist to:

- Do nothing - inform patient of the finding, but there is no need for workup or referral
- Ask additional questions regarding sinonasal symptoms, and refer to primary care provider/physician or otolaryngologist only if positive for symptoms
- Immediately refer to primary care provider/physician
- Immediately refer to otolaryngologist

Comments:



SMALL MUCOCELE/CYSTIC LESION

Do nothing – inform patient of the finding, but no need for workup or referral	61.3%
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	35.5%
Immediately refer to primary care provider/physician	0.0%
Immediately refer to otolaryngologist	3.2%

Comments: “but again, happy to be the one to answer rather haven’t he dentist explain”



UNIVERSITY OF MINNESOTA
Driven to Discover™

We thank you for your time spent taking this survey.
Your response has been recorded.

Appendix B: Case Responses in terms of Years in Practice

ADENOID HYPERTROPHY		YEARS IN PRACTICE			
		0-5 yr	6-20 yr	20+ yr	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	1	3	2	6
	Percent (%)	3.23	9.68	6.45	19.35
	Row %	16.67	50.00	33.33	
	Column %	25.00	17.65	20.00	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	2	7	6	15
	Percent (%)	6.45	22.58	19.35	48.39
	Row %	13.33	46.67	40.00	
	Column %	50.00	41.18	60.00	
Immediately refer to primary care provider/physician	Frequency	0	1	0	1
	Percent (%)	0.00	3.23	0.00	3.23
	Row %	0.00	100.00	0.00	
	Column %	0.00	5.88	0.00	
Immediately refer to otolaryngologist	Frequency	1	6	2	9
	Percent (%)	3.23	19.35	6.45	29.03
	Row %	11.11	66.67	22.22	
	Column %	25.00	35.29	20.00	
Total	Frequency	4	17	10	31
	Percent (%)	12.90	54.84	32.26	100.00

AIR-FLUID LEVEL #1		YEARS IN PRACTICE			
		0-5 yr	6-20 yr	20+ yr	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	0	0	0	0
	Percent (%)	0.00	0.00	0.00	0.00
	Row %	0.00	0.00	0.00	
	Column %	0.00	0.00	0.00	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	3	6	4	13
	Percent (%)	9.68	19.35	12.90	41.94
	Row %	23.08	46.15	30.77	
	Column %	75.00	35.29	40.00	
Immediately refer to primary care provider/physician	Frequency	1	5	1	7
	Percent (%)	3.23	16.13	3.23	22.58
	Row %	14.29	71.43	14.29	
	Column %	25.00	29.41	10.00	
Immediately refer to otolaryngologist	Frequency	0	6	5	11
	Percent (%)	0.00	19.35	16.13	35.48
	Row %	0.00	54.55	45.45	
	Column %	0.00	35.29	50.00	
Total	Frequency	4	17	10	31
	Percent (%)	12.90	54.84	32.26	100.00

AIR-FLUID LEVEL #2		YEARS IN PRACTICE			
		0-5 yr	6-20 yr	20+ yr	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	0	0	0	0
	Percent (%)	0.00	0.00	0.00	0.00
	Row %	0.00	0.00	0.00	
	Column %	0.00	0.00	0.00	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	4	11	4	19
	Percent (%)	12.50	34.38	12.50	59.38
	Row %	21.05	57.89	21.05	
	Column %	100.00	61.11	40.00	
Immediately refer to primary care provider/physician	Frequency	0	4	2	6
	Percent (%)	0.00	12.50	6.25	18.75
	Row %	0.00	66.67	33.33	
	Column %	0.00	22.22	20.00	
Immediately refer to otolaryngologist	Frequency	0	3	4	7
	Percent (%)	0.00	9.38	12.50	21.88
	Row %	0.00	42.86	57.14	
	Column %	0.00	16.67	40.00	
Total	Frequency	4	18	10	32
	Percent (%)	12.50	56.25	31.25	100.00

ANTROLITH/FOREIGN BODY		YEARS IN PRACTICE			
		0-5 yr	6-20 yr	20+ yr	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	3	6	4	13
	Percent (%)	8.82	17.65	11.76	38.24
	Row %	23.08	46.15	30.77	
	Column %	75.00	31.58	36.36	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	0	9	3	12
	Percent (%)	0.00	26.47	8.82	35.29
	Row %	0.00	75.00	25.00	
	Column %	0.00	47.37	27.27	
Immediately refer to primary care provider/physician	Frequency	0	1	0	1
	Percent (%)	0.00	2.94	0.00	2.94
	Row %	0.00	100.00	0.00	
	Column %	0.00	5.26	0.00	
Immediately refer to otolaryngologist	Frequency	1	3	4	8
	Percent (%)	2.94	8.82	11.76	23.53
	Row %	12.50	37.50	50.00	
	Column %	25.00	15.79	36.36	
Total	Frequency	4	19	11	34
	Percent (%)	11.76	55.88	32.35	100.00

BLOCKED OSTIOMEATAL UNIT		YEARS IN PRACTICE			
		0-5 yr	6-20 yr	20+ yr	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	0	0	2	2
	Percent (%)	0.00	0.00	5.88	5.88
	Row %	0.00	0.00	100.00	
	Column %	0.00	0.00	18.18	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	3	12	7	22
	Percent (%)	8.82	35.29	20.59	64.71
	Row %	13.64	54.55	31.82	
	Column %	75.00	63.16	63.64	
Immediately refer to primary care provider/physician	Frequency	0	0	0	0
	Percent (%)	0.00	0.00	0.00	0.00
	Row %	0.00	0.00	0.00	
	Column %	0.00	0.00	0.00	
Immediately refer to otolaryngologist	Frequency	1	7	2	10
	Percent (%)	2.94	20.59	5.88	29.41
	Row %	10.00	70.00	20.00	
	Column %	25.00	36.84	18.18	
Total	Frequency	4	19	11	34
	Percent (%)	11.76	55.88	32.35	100.00

BONE EROSION OF SINUS WALL		YEARS IN PRACTICE			
		0-5 yr	6-20 yr	20+ yr	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	0	0	0	0
	Percent (%)	0.00	0.00	0.00	0.00
	Row %	0.00	0.00	0.00	
	Column %	0.00	0.00	0.00	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	0	1	0	1
	Percent (%)	0.00	3.03	0.00	3.03
	Row %	0.00	100.00	0.00	
	Column %	0.00	5.26	0.00	
Immediately refer to primary care provider/physician	Frequency	0	0	0	0
	Percent (%)	0.00	0.00	0.00	0.00
	Row %	0.00	0.00	0.00	
	Column %	0.00	0.00	0.00	
Immediately refer to otolaryngologist	Frequency	4	18	10	32
	Percent (%)	12.12	54.55	30.30	96.97
	Row %	12.50	56.25	31.25	
	Column %	100.00	94.74	100.00	
Total	Frequency	4	19	10	33
	Percent (%)	12.12	57.58	30.30	100.00

CONCHA BULLOSA		YEARS IN PRACTICE			
		0-5 yr	6-20 yr	20+ yr	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	1	7	1	9
	Percent (%)	3.33	23.33	3.33	30.00
	Row %	11.11	77.78	11.11	
	Column %	25.00	43.75	10.00	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	3	9	7	19
	Percent (%)	10.00	30.00	23.33	63.33
	Row %	15.79	47.37	36.84	
	Column %	75.00	56.25	70.00	
Immediately refer to primary care provider/physician	Frequency	0	0	0	0
	Percent (%)	0.00	0.00	0.00	0.00
	Row %	0.00	0.00	0.00	
	Column %	0.00	0.00	0.00	
Immediately refer to otolaryngologist	Frequency	0	0	2	2
	Percent (%)	0.00	0.00	6.67	6.67
	Row %	0.00	0.00	100.00	
	Column %	0.00	0.00	20.00	
Total	Frequency	4	16	10	30
	Percent (%)	13.33	53.33	33.33	100.00

FIBROUS DYSPLASIA		YEARS IN PRACTICE			
		0-5 yr	6-20 yr	20+ yr	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	0	0	0	0
	Percent (%)	0.00	0.00	0.00	0.00
	Row %	0.00	0.00	0.00	
	Column %	0.00	0.00	0.00	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	0	1	0	1
	Percent (%)	0.00	3.23	0.00	3.23
	Row %	0.00	100.00	0.00	
	Column %	0.00	5.88	0.00	
Immediately refer to primary care provider/physician	Frequency	0	1	0	1
	Percent (%)	0.00	3.23	0.00	3.23
	Row %	0.00	100.00	0.00	
	Column %	0.00	5.88	0.00	
Immediately refer to otolaryngologist	Frequency	4	15	10	29
	Percent (%)	12.90	48.39	32.26	93.55
	Row %	13.79	51.72	34.48	
	Column %	100.00	88.24	100.00	
Total	Frequency	4	17	10	31
	Percent (%)	12.90	54.84	32.26	100.00

HETEROGENEOUS OPAC. #1		YEARS IN PRACTICE			
		0-5 yr	6-20 yr	20+ yr	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	0	0	0	0
	Percent (%)	0.00	0.00	0.00	0.00
	Row %	0.00	0.00	0.00	
	Column %	0.00	0.00	0.00	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	0	3	0	3
	Percent (%)	0.00	9.38	0.00	9.38
	Row %	0.00	100.00	0.00	
	Column %	0.00	16.67	0.00	
Immediately refer to primary care provider/physician	Frequency	0	1	0	1
	Percent (%)	0.00	3.13	0.00	3.13
	Row %	0.00	100.00	0.00	
	Column %	0.00	5.56	0.00	
Immediately refer to otolaryngologist	Frequency	4	14	10	28
	Percent (%)	12.50	43.75	31.25	87.50
	Row %	14.29	50.00	35.71	
	Column %	100.00	77.78	100.00	
Total	Frequency	4	18	10	32
	Percent (%)	12.50	56.25	31.25	100.00

HETEROGENEOUS OPAC. #2		YEARS IN PRACTICE			
		0-5 yr	6-20 yr	20+ yr	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	0	0	0	0
	Percent (%)	0.00	0.00	0.00	0.00
	Row %	0.00	0.00	0.00	
	Column %	0.00	0.00	0.00	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	0	1	1	2
	Percent (%)	0.00	3.23	3.23	6.45
	Row %	0.00	50.00	50.00	
	Column %	0.00	5.88	10.00	
Immediately refer to primary care provider/physician	Frequency	0	0	0	0
	Percent (%)	0.00	0.00	0.00	0.00
	Row %	0.00	0.00	0.00	
	Column %	0.00	0.00	0.00	
Immediately refer to otolaryngologist	Frequency	4	16	9	29
	Percent (%)	12.90	51.61	29.03	93.55
	Row %	13.79	55.17	31.03	
	Column %	100.00	94.12	90.00	
Total	Frequency	4	17	10	31
	Percent (%)	12.90	54.84	32.26	100.00

LARGE MUCOCELE/CYSTIC LESION		YEARS IN PRACTICE			
		0-5 yr	6-20 yr	20+ yr	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	0	0	0	0
	Percent (%)	0.00	0.00	0.00	0.00
	Row %	0.00	0.00	0.00	
	Column %	0.00	0.00	0.00	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	3	9	7	19
	Percent (%)	9.09	27.27	21.21	57.58
	Row %	15.79	47.37	36.84	
	Column %	75.00	47.37	70.00	
Immediately refer to primary care provider/physician	Frequency	0	2	0	2
	Percent (%)	0.00	6.06	0.00	6.06
	Row %	0.00	100.00	0.00	
	Column %	0.00	10.53	0.00	
Immediately refer to otolaryngologist	Frequency	1	8	3	12
	Percent (%)	3.03	24.24	9.09	36.36
	Row %	8.33	66.67	25.00	
	Column %	25.00	42.11	30.00	
Total	Frequency	4	19	10	33
	Percent (%)	12.12	57.58	30.30	100.00

MUCOSAL THICK. OF SINUS FLOOR		YEARS IN PRACTICE			
		0-5 yr	6-20 yr	20+ yr	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	0	0	0	0
	Percent (%)	0.00	0.00	0.00	0.00
	Row %	0.00	0.00	0.00	
	Column %	0.00	0.00	0.00	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	4	12	6	22
	Percent (%)	12.12	36.36	18.18	66.67
	Row %	18.18	54.55	27.27	
	Column %	100.00	63.16	60.00	
Immediately refer to primary care provider/physician	Frequency	0	4	1	5
	Percent (%)	0.00	12.12	3.03	15.15
	Row %	0.00	80.00	20.00	
	Column %	0.00	21.05	10.00	
Immediately refer to otolaryngologist	Frequency	0	3	3	6
	Percent (%)	0.00	9.09	9.09	18.18
	Row %	0.00	50.00	50.00	
	Column %	0.00	15.79	30.00	
Total	Frequency	4	19	10	33
	Percent (%)	12.12	57.58	30.30	100.00

PALATINE TONSIL HYPERTROPHY		YEARS IN PRACTICE			
		0-5 yr	6-20 yr	20+ yr	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	0	2	0	2
	Percent (%)	0.00	6.45	0.00	6.45
	Row %	0.00	100.00	0.00	
	Column %	0.00	11.76	0.00	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	3	10	4	17
	Percent (%)	9.68	32.26	12.90	54.84
	Row %	17.65	58.82	23.53	
	Column %	75.00	58.82	40.00	
Immediately refer to primary care provider/physician	Frequency	0	1	0	1
	Percent (%)	0.00	3.23	0.00	3.23
	Row %	0.00	100.00	0.00	
	Column %	0.00	5.88	0.00	
Immediately refer to otolaryngologist	Frequency	1	4	6	11
	Percent (%)	3.23	12.90	19.35	35.48
	Row %	9.09	36.36	54.55	
	Column %	25.00	23.53	60.00	
Total	Frequency	4	17	10	31
	Percent (%)	12.90	54.84	32.26	100.00

POLYPOID MUCOSAL THICKENING		YEARS IN PRACTICE			
		0-5 yr	6-20 yr	20+ yr	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	0	0	0	0
	Percent (%)	0.00	0.00	0.00	0.00
	Row %	0.00	0.00	0.00	
	Column %	0.00	0.00	0.00	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	2	8	3	13
	Percent (%)	6.45	25.81	9.68	41.94
	Row %	15.38	61.54	23.08	
	Column %	50.00	47.06	30.00	
Immediately refer to primary care provider/physician	Frequency	0	1	0	1
	Percent (%)	0.00	3.23	0.00	3.23
	Row %	0.00	100.00	0.00	
	Column %	0.00	5.88	0.00	
Immediately refer to otolaryngologist	Frequency	2	8	7	17
	Percent (%)	6.45	25.81	22.58	54.84
	Row %	11.76	47.06	41.18	
	Column %	50.00	47.06	70.00	
Total	Frequency	4	17	10	31
	Percent (%)	12.90	54.84	32.26	100.00

SEPTAL DEVIATION/SEPTAL SPUR		YEARS IN PRACTICE			
		0-5 yr	6-20 yr	20+ yr	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	0	2	1	3
	Percent (%)	0.00	6.06	3.03	9.09
	Row %	0.00	66.67	33.33	
	Column %	0.00	10.53	10.00	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	4	16	7	27
	Percent (%)	12.12	48.48	21.21	81.82
	Row %	14.81	59.26	25.93	
	Column %	100.00	84.21	70.00	
Immediately refer to primary care provider/physician	Frequency	0	1	0	1
	Percent (%)	0.00	3.03	0.00	3.03
	Row %	0.00	100.00	0.00	
	Column %	0.00	5.26	0.00	
Immediately refer to otolaryngologist	Frequency	0	0	2	2
	Percent (%)	0.00	0.00	6.06	6.06
	Row %	0.00	0.00	100.00	
	Column %	0.00	0.00	20.00	
Total	Frequency	4	19	10	33
	Percent (%)	12.12	57.58	30.30	100.00

SEPTAL PERFORATION		YEARS IN PRACTICE			
		0-5 yr	6-20 yr	20+ yr	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	1	4	0	5
	Percent (%)	3.13	12.50	0.00	15.63
	Row %	20.00	80.00	0.00	
	Column %	25.00	22.22	0.00	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	0	4	5	9
	Percent (%)	0.00	12.50	15.63	28.13
	Row %	0.00	44.44	55.56	
	Column %	0.00	22.22	50.00	
Immediately refer to primary care provider/physician	Frequency	1	1	0	2
	Percent (%)	3.13	3.13	0.00	6.25
	Row %	50.00	50.00	0.00	
	Column %	25.00	5.56	0.00	
Immediately refer to otolaryngologist	Frequency	2	9	5	16
	Percent (%)	6.25	28.13	15.63	50.00
	Row %	12.50	56.25	31.25	
	Column %	50.00	50.00	50.00	
Total	Frequency	4	18	10	32
	Percent (%)	12.50	56.25	31.25	100.00

SINUS HYPOPLASIA		YEARS IN PRACTICE			
		0-5 yr	6-20 yr	20+ yr	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	2	4	4	10
	Percent (%)	5.88	11.76	11.76	29.41
	Row %	20.00	40.00	40.00	
	Column %	50.00	21.05	36.36	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	2	11	7	20
	Percent (%)	5.88	32.35	20.59	58.82
	Row %	10.00	55.00	35.00	
	Column %	50.00	57.89	63.64	
Immediately refer to primary care provider/physician	Frequency	0	0	0	0
	Percent (%)	0.00	0.00	0.00	0.00
	Row %	0.00	0.00	0.00	
	Column %	0.00	0.00	0.00	
Immediately refer to otolaryngologist	Frequency	0	4	0	4
	Percent (%)	0.00	11.76	0.00	11.76
	Row %	0.00	100.00	0.00	
	Column %	0.00	21.05	0.00	
Total	Frequency	4	19	11	34
	Percent (%)	11.76	55.88	32.35	100.00

SINUS OPAC. WITH BONE EROSION		YEARS IN PRACTICE			
		0-5 yr	6-20 yr	20+ yr	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	0	0	0	0
	Percent (%)	0.00	0.00	0.00	0.00
	Row %	0.00	0.00	0.00	
	Column %	0.00	0.00	0.00	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	1	0	0	1
	Percent (%)	3.23	0.00	0.00	3.23
	Row %	100.00	0.00	0.00	
	Column %	25.00	0.00	0.00	
Immediately refer to primary care provider/physician	Frequency	0	0	0	0
	Percent (%)	0.00	0.00	0.00	0.00
	Row %	0.00	0.00	0.00	
	Column %	0.00	0.00	0.00	
Immediately refer to otolaryngologist	Frequency	3	17	10	30
	Percent (%)	9.68	54.84	32.26	96.77
	Row %	10.00	56.67	33.33	
	Column %	75.00	100.00	100.00	
Total	Frequency	4	17	10	31
	Percent (%)	12.90	54.84	32.26	100.00

SINUS OSTEOMYELITIS		YEARS IN PRACTICE			
		0-5 yr	6-20 yr	20+ yr	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	0	0	1	1
	Percent (%)	0.00	0.00	2.78	2.78
	Row %	0.00	0.00	100.00	
	Column %	0.00	0.00	8.33	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	1	1	4	6
	Percent (%)	2.78	2.78	11.11	16.67
	Row %	16.67	16.67	66.67	
	Column %	25.00	5.00	33.33	
Immediately refer to primary care provider/physician	Frequency	0	0	1	1
	Percent (%)	0.00	0.00	2.78	2.78
	Row %	0.00	0.00	100.00	
	Column %	0.00	0.00	8.33	
Immediately refer to otolaryngologist	Frequency	3	19	6	28
	Percent (%)	8.33	52.78	16.67	77.78
	Row %	10.71	67.86	21.43	
	Column %	75.00	95.00	50.00	
Total	Frequency	4	20	12	36
	Percent (%)	11.11	55.56	33.33	100.00

SMALL MUCOCELE/CYSTIC LESION		YEARS IN PRACTICE			
		0-5 yr	6-20 yr	20+ yr	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	2	14	3	19
	Percent (%)	6.45	45.16	9.68	61.29
	Row %	10.53	73.68	15.79	
	Column %	50.00	82.35	30.00	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	2	3	6	11
	Percent (%)	6.45	9.68	19.35	35.48
	Row %	18.18	27.27	54.55	
	Column %	50.00	17.65	60.00	
Immediately refer to primary care provider/physician	Frequency	0	0	0	0
	Percent (%)	0.00	0.00	0.00	0.00
	Row %	0.00	0.00	0.00	
	Column %	0.00	0.00	0.00	
Immediately refer to otolaryngologist	Frequency	0	0	1	1
	Percent (%)	0.00	0.00	3.23	3.23
	Row %	0.00	0.00	100.00	
	Column %	0.00	0.00	10.00	
Total	Frequency	4	17	10	31
	Percent (%)	12.90	54.84	32.26	100.00

Appendix C: Case Responses in terms of Location of Training

ADENOID HYPERTROPHY	LOCATION OF TRAINING			
	Midwest	Others	Total	
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	1	3	2
	Percent (%)	3.23	9.68	6.45
	Row %	16.67	50.00	33.33
	Column %	25.00	17.65	20.00
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	2	7	6
	Percent (%)	6.45	22.58	19.35
	Row %	13.33	46.67	40.00
	Column %	50.00	41.18	60.00
Immediately refer to primary care provider/physician	Frequency	0	1	0
	Percent (%)	0.00	3.23	0.00
	Row %	0.00	100.00	0.00
	Column %	0.00	5.88	0.00
Immediately refer to otolaryngologist	Frequency	1	6	2
	Percent (%)	3.23	19.35	6.45
	Row %	11.11	66.67	22.22
	Column %	25.00	35.29	20.00
Total	Frequency	4	17	10
	Percent (%)	12.90	54.84	32.26

AIR-FLUID LEVEL #1	LOCATION OF TRAINING			
	Midwest	Others	Total	
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	0	0	0
	Percent (%)	0.00	0.00	0.00
	Row %	0.00	0.00	0.00
	Column %	0.00	0.00	0.00
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	3	6	4
	Percent (%)	9.68	19.35	12.90
	Row %	23.08	46.15	30.77
	Column %	75.00	35.29	40.00
Immediately refer to primary care provider/physician	Frequency	1	5	1
	Percent (%)	3.23	16.13	3.23
	Row %	14.29	71.43	14.29
	Column %	25.00	29.41	10.00
Immediately refer to otolaryngologist	Frequency	0	6	5
	Percent (%)	0.00	19.35	16.13
	Row %	0.00	54.55	45.45
	Column %	0.00	35.29	50.00
Total	Frequency	4	17	10
	Percent (%)	12.90	54.84	32.26

AIR-FLUID LEVEL #2	LOCATION OF TRAINING			
	Midwest	Others	Total	
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	0	0	0
	Percent (%)	0.00	0.00	0.00
	Row %	0.00	0.00	0.00
	Column %	0.00	0.00	0.00
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	4	11	4
	Percent (%)	12.50	34.38	12.50
	Row %	21.05	57.89	21.05
	Column %	100.00	61.11	40.00
Immediately refer to primary care provider/physician	Frequency	0	4	2
	Percent (%)	0.00	12.50	6.25
	Row %	0.00	66.67	33.33
	Column %	0.00	22.22	20.00
Immediately refer to otolaryngologist	Frequency	0	3	4
	Percent (%)	0.00	9.38	12.50
	Row %	0.00	42.86	57.14
	Column %	0.00	16.67	40.00
Total	Frequency	4	18	10
	Percent (%)	12.50	56.25	31.25

ANTROLITH/FOREIGN BODY	LOCATION OF TRAINING			
	Midwest	Others	Total	
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	3	6	4
	Percent (%)	8.82	17.65	11.76
	Row %	23.08	46.15	30.77
	Column %	75.00	31.58	36.36
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	0	9	3
	Percent (%)	0.00	26.47	8.82
	Row %	0.00	75.00	25.00
	Column %	0.00	47.37	27.27
Immediately refer to primary care provider/physician	Frequency	0	1	0
	Percent (%)	0.00	2.94	0.00
	Row %	0.00	100.00	0.00
	Column %	0.00	5.26	0.00
Immediately refer to otolaryngologist	Frequency	1	3	4
	Percent (%)	2.94	8.82	11.76
	Row %	12.50	37.50	50.00
	Column %	25.00	15.79	36.36
Total	Frequency	4	19	11
	Percent (%)	11.76	55.88	32.35

BLOCKED OSTIOMEATAL UNIT	LOCATION OF TRAINING			
	Midwest	Others	Total	
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	0	0	2
	Percent (%)	0.00	0.00	5.88
	Row %	0.00	0.00	100.00
	Column %	0.00	0.00	18.18
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	3	12	7
	Percent (%)	8.82	35.29	20.59
	Row %	13.64	54.55	31.82
	Column %	75.00	63.16	63.64
Immediately refer to primary care provider/physician	Frequency	0	0	0
	Percent (%)	0.00	0.00	0.00
	Row %	0.00	0.00	0.00
	Column %	0.00	0.00	0.00
Immediately refer to otolaryngologist	Frequency	1	7	2
	Percent (%)	2.94	20.59	5.88
	Row %	10.00	70.00	20.00
	Column %	25.00	36.84	18.18
Total	Frequency	4	19	11
	Percent (%)	11.76	55.88	32.35

BONE EROSION OF SINUS WALL	LOCATION OF TRAINING			
	Midwest	Others	Total	
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	0	0	0
	Percent (%)	0.00	0.00	0.00
	Row %	0.00	0.00	0.00
	Column %	0.00	0.00	0.00
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	0	1	0
	Percent (%)	0.00	3.03	0.00
	Row %	0.00	100.00	0.00
	Column %	0.00	5.26	0.00
Immediately refer to primary care provider/physician	Frequency	0	0	0
	Percent (%)	0.00	0.00	0.00
	Row %	0.00	0.00	0.00
	Column %	0.00	0.00	0.00
Immediately refer to otolaryngologist	Frequency	4	18	10
	Percent (%)	12.12	54.55	30.30
	Row %	12.50	56.25	31.25
	Column %	100.00	94.74	100.00
Total	Frequency	4	19	10
	Percent (%)	12.12	57.58	30.30

CONCHA BULLOSA	LOCATION OF TRAINING			
	Midwest	Others	Total	
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	1	7	1
	Percent (%)	3.33	23.33	3.33
	Row %	11.11	77.78	11.11
	Column %	25.00	43.75	10.00
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	3	9	7
	Percent (%)	10.00	30.00	23.33
	Row %	15.79	47.37	36.84
	Column %	75.00	56.25	70.00
Immediately refer to primary care provider/physician	Frequency	0	0	0
	Percent (%)	0.00	0.00	0.00
	Row %	0.00	0.00	0.00
	Column %	0.00	0.00	0.00
Immediately refer to otolaryngologist	Frequency	0	0	2
	Percent (%)	0.00	0.00	6.67
	Row %	0.00	0.00	100.00
	Column %	0.00	0.00	20.00
Total	Frequency	4	16	10
	Percent (%)	13.33	53.33	33.33

DISRUPTED SINUS WALL	LOCATION OF TRAINING			
	Midwest	Others	Total	
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	2	8	2
	Percent (%)	5.56	22.22	5.56
	Row %	16.67	66.67	16.67
	Column %	50.00	40.00	16.67
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	2	8	8
	Percent (%)	5.56	22.22	22.22
	Row %	11.11	44.44	44.44
	Column %	50.00	40.00	66.67
Immediately refer to primary care provider/physician	Frequency	0	0	0
	Percent (%)	0.00	0.00	0.00
	Row %	0.00	0.00	0.00
	Column %	0.00	0.00	0.00
Immediately refer to otolaryngologist	Frequency	0	4	2
	Percent (%)	0.00	11.11	5.56
	Row %	0.00	66.67	33.33
	Column %	0.00	20.00	16.67
Total	Frequency	4	20	12
	Percent (%)	11.11	55.56	33.33

ETHMOID SINUSITIS		LOCATION OF TRAINING		
		Midwest	Others	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	0	0	0
	Percent (%)	0.00	0.00	0.00
	Row %	0.00	0.00	
	Column %	0.00	0.00	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	2	1	3
	Percent (%)	6.67	3.33	10.00
	Row %	66.67	33.33	
	Column %	9.52	11.11	
Immediately refer to primary care provider/physician	Frequency	0	0	0
	Percent (%)	0.00	0.00	0.00
	Row %	0.00	0.00	
	Column %	0.00	0.00	
Immediately refer to otolaryngologist	Frequency	19	8	27
	Percent (%)	63.33	26.67	90.00
	Row %	70.37	29.63	
	Column %	90.48	88.89	
Total	Frequency	21	9	30
	Percent (%)	70.00	30.00	100.00

FIBROUS DYSPLASIA		LOCATION OF TRAINING		
		Midwest	Others	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	0	0	0
	Percent (%)	0.00	0.00	0.00
	Row %	0.00	0.00	
	Column %	0.00	0.00	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	1	0	1
	Percent (%)	3.23	0.00	3.23
	Row %	100.00	0.00	
	Column %	4.55	0.00	
Immediately refer to primary care provider/physician	Frequency	1	0	1
	Percent (%)	3.23	0.00	3.23
	Row %	100.00	0.00	
	Column %	4.55	0.00	
Immediately refer to otolaryngologist	Frequency	20	9	29
	Percent (%)	64.52	29.03	93.55
	Row %	68.97	31.03	
	Column %	90.91	100.00	
Total	Frequency	22	9	31
	Percent (%)	70.97	29.03	100.00

HETEROGENEOUS OPAC. OF SINUS #1		LOCATION OF TRAINING		
		Midwest	Others	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	0	0	0
	Percent (%)	0.00	0.00	0.00
	Row %	0.00	0.00	
	Column %	0.00	0.00	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	3	0	3
	Percent (%)	9.38	0.00	9.38
	Row %	100.00	0.00	
	Column %	13.04	0.00	
Immediately refer to primary care provider/physician	Frequency	1	0	1
	Percent (%)	3.13	0.00	3.13
	Row %	100.00	0.00	
	Column %	4.35	0.00	
Immediately refer to otolaryngologist	Frequency	19	9	28
	Percent (%)	59.38	28.13	87.50
	Row %	67.86	32.14	
	Column %	82.61	100.00	
Total	Frequency	23	9	32
	Percent (%)	71.88	28.13	100.00

HETEROGENEOUS OPAC. OF SINUS #2		LOCATION OF TRAINING		
		Midwest	Others	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	0	0	0
	Percent (%)	0.00	0.00	0.00
	Row %	0.00	0.00	
	Column %	0.00	0.00	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	2	0	2
	Percent (%)	6.45	0.00	6.45
	Row %	100.00	0.00	
	Column %	9.09	0.00	
Immediately refer to primary care provider/physician	Frequency	0	0	0
	Percent (%)	0.00	0.00	0.00
	Row %	0.00	0.00	
	Column %	0.00	0.00	
Immediately refer to otolaryngologist	Frequency	20	9	29
	Percent (%)	64.52	29.03	93.55
	Row %	68.97	31.03	
	Column %	90.91	100.00	
Total	Frequency	22	9	31
	Percent (%)	70.97	29.03	100.00

LARGE MUCOCELE/CYSTIC LESION	LOCATION OF TRAINING			
	Midwest	Others	Total	
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	0	0	0
	Percent (%)	0.00	0.00	0.00
	Row %	0.00	0.00	
	Column %	0.00	0.00	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	14	5	19
	Percent (%)	42.42	15.15	57.58
	Row %	73.68	26.32	
	Column %	58.33	55.56	
Immediately refer to primary care provider/physician	Frequency	2	0	2
	Percent (%)	6.06	0.00	6.06
	Row %	100.00	0.00	
	Column %	8.33	0.00	
Immediately refer to otolaryngologist	Frequency	8	4	12
	Percent (%)	24.24	12.12	36.36
	Row %	66.67	33.33	
	Column %	33.33	44.44	
Total	Frequency	24	9	33
	Percent (%)	72.73	27.27	100.00

MUCOSAL THICKENING OF SINUS FLOOR	LOCATION OF TRAINING			
	Midwest	Others	Total	
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	0	0	0
	Percent (%)	0.00	0.00	0.00
	Row %	0.00	0.00	
	Column %	0.00	0.00	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	16	6	22
	Percent (%)	48.48	18.18	66.67
	Row %	72.73	27.27	
	Column %	66.67	66.67	
Immediately refer to primary care provider/physician	Frequency	4	1	5
	Percent (%)	12.12	3.03	15.15
	Row %	80.00	20.00	
	Column %	16.67	11.11	
Immediately refer to otolaryngologist	Frequency	4	2	6
	Percent (%)	12.12	6.06	18.18
	Row %	66.67	33.33	
	Column %	16.67	22.22	
Total	Frequency	24	9	33
	Percent (%)	72.73	27.27	100.00

PALATINE TONSIL HYPERTROPHY		LOCATION OF TRAINING		
		Midwest	Others	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	2	0	2
	Percent (%)	6.45	0.00	6.45
	Row %	100.00	0.00	
	Column %	9.09	0.00	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	11	6	17
	Percent (%)	35.48	19.35	54.84
	Row %	64.71	35.29	
	Column %	50.00	66.67	
Immediately refer to primary care provider/physician	Frequency	1	0	1
	Percent (%)	3.23	0.00	3.23
	Row %	100.00	0.00	
	Column %	4.55	0.00	
Immediately refer to otolaryngologist	Frequency	8	3	11
	Percent (%)	25.81	9.68	35.48
	Row %	72.73	27.27	
	Column %	36.36	33.33	
Total	Frequency	22	9	31
	Percent (%)	70.97	29.03	100.00

POLYPOID MUCOSAL THICKENING		LOCATION OF TRAINING		
		Midwest	Others	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	0	0	0
	Percent (%)	0.00	0.00	0.00
	Row %	0.00	0.00	
	Column %	0.00	0.00	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	9	4	13
	Percent (%)	29.03	12.90	41.94
	Row %	69.23	30.77	
	Column %	40.91	44.44	
Immediately refer to primary care provider/physician	Frequency	1	0	1
	Percent (%)	3.23	0.00	3.23
	Row %	100.00	0.00	
	Column %	4.55	0.00	
Immediately refer to otolaryngologist	Frequency	12	5	17
	Percent (%)	38.71	16.13	54.84
	Row %	70.59	29.41	
	Column %	54.55	55.56	
Total	Frequency	22	9	31
	Percent (%)	70.97	29.03	100.00

SEPTAL DEVIATION/SEPTAL SPUR		LOCATION OF TRAINING		
		Midwest	Others	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	2	1	3
	Percent (%)	6.06	3.03	9.09
	Row %	66.67	33.33	
	Column %	8.33	11.11	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	19	8	27
	Percent (%)	57.58	24.24	81.82
	Row %	70.37	29.63	
	Column %	79.17	88.89	
Immediately refer to primary care provider/physician	Frequency	1	0	1
	Percent (%)	3.03	0.00	3.03
	Row %	100.00	0.00	
	Column %	4.17	0.00	
Immediately refer to otolaryngologist	Frequency	2	0	2
	Percent (%)	6.06	0.00	6.06
	Row %	100.00	0.00	
	Column %	8.33	0.00	
Total	Frequency	24	9	33
	Percent (%)	72.73	27.27	100.00

SEPTAL PERFORATION		LOCATION OF TRAINING		
		Midwest	Others	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	4	1	5
	Percent (%)	12.50	3.13	15.63
	Row %	80.00	20.00	
	Column %	17.39	11.11	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	7	2	9
	Percent (%)	21.88	6.25	28.13
	Row %	77.78	22.22	
	Column %	30.43	22.22	
Immediately refer to primary care provider/physician	Frequency	2	0	2
	Percent (%)	6.25	0.00	6.25
	Row %	100.00	0.00	
	Column %	8.70	0.00	
Immediately refer to otolaryngologist	Frequency	10	6	16
	Percent (%)	31.25	18.75	50.00
	Row %	62.50	37.50	
	Column %	43.48	66.67	
Total	Frequency	23	9	32
	Percent (%)	71.88	28.13	100.00

SINUS HYPOPLASIA		LOCATION OF TRAINING		
		Midwest	Others	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	7	3	10
	Percent (%)	20.59	8.82	29.41
	Row %	70.00	30.00	
	Column %	28.00	33.33	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	15	5	20
	Percent (%)	44.12	14.71	58.82
	Row %	75.00	25.00	
	Column %	60.00	55.56	
Immediately refer to primary care provider/physician	Frequency	0	0	0
	Percent (%)	0.00	0.00	0.00
	Row %	0.00	0.00	
	Column %	0.00	0.00	
Immediately refer to otolaryngologist	Frequency	3	1	4
	Percent (%)	8.82	2.94	11.76
	Row %	75.00	25.00	
	Column %	12.00	11.11	
Total	Frequency	25	9	34
	Percent (%)	73.53	26.47	100.00

SINUS OPACIFICATION WITH BONE EROSION		LOCATION OF TRAINING		
		Midwest	Others	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	0	0	0
	Percent (%)	0.00	0.00	0.00
	Row %	0.00	0.00	
	Column %	0.00	0.00	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	1	0	1
	Percent (%)	3.23	0.00	3.23
	Row %	100.00	0.00	
	Column %	4.55	0.00	
Immediately refer to primary care provider/physician	Frequency	0	0	0
	Percent (%)	0.00	0.00	0.00
	Row %	0.00	0.00	
	Column %	0.00	0.00	
Immediately refer to otolaryngologist	Frequency	21	9	30
	Percent (%)	67.74	29.03	96.77
	Row %	70.00	30.00	
	Column %	95.45	100.00	
Total	Frequency	22	9	31
	Percent (%)	70.97	29.03	100.00

SINUS OSTEOMYELITIS		LOCATION OF TRAINING		
		Midwest	Others	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	1	0	1
	Percent (%)	2.78	0.00	2.78
	Row %	100.00	0.00	
	Column %	3.85	0.00	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	4	2	6
	Percent (%)	11.11	5.56	16.67
	Row %	66.67	33.33	
	Column %	15.38	20.00	
Immediately refer to primary care provider/physician	Frequency	0	1	1
	Percent (%)	0.00	2.78	2.78
	Row %	0.00	100.00	
	Column %	0.00	10.00	
Immediately refer to otolaryngologist	Frequency	21	7	28
	Percent (%)	58.33	19.44	77.78
	Row %	75.00	25.00	
	Column %	80.77	70.00	
Total	Frequency	26	10	36
	Percent (%)	72.22	27.78	100.00

SMALL MUCOCELE/CYSTIC LESION		LOCATION OF TRAINING		
		Midwest	Others	Total
Do nothing – inform patient of the finding, but no need for workup or referral	Frequency	14	5	19
	Percent (%)	45.16	16.13	61.29
	Row %	73.68	26.32	
	Column %	63.64	55.56	
Ask additional questions regarding sinonasal symptoms, and refer only if positive for symptoms	Frequency	7	4	11
	Percent (%)	22.58	12.90	35.48
	Row %	63.64	36.36	
	Column %	31.82	44.44	
Immediately refer to primary care provider/physician	Frequency	0	0	0
	Percent (%)	0.00	0.00	0.00
	Row %	0.00	0.00	
	Column %	0.00	0.00	
Immediately refer to otolaryngologist	Frequency	1	0	1
	Percent (%)	3.23	0.00	3.23
	Row %	100.00	0.00	
	Column %	4.55	0.00	
Total	Frequency	22	9	31
	Percent (%)	70.97	29.03	100.00