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**DISSERTAÇÃO DE MESTRADO
MODALIDADE ARTIGO(S) CIENTÍFICO(S)**

**Ocorrência de anormalidades nos seios maxilares detectadas
por meio da tomografia computadorizada por feixe cônico
(TCFC) em pacientes assintomáticos**

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**Goiânia
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Dedicatória

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(Música: És o meu bem querer
Letra: Marcos Goes)

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Lista de siglas e abreviaturas

	Português		Inglês
SM	Seio maxilar	MS	Maxillary sinus
TC	Tomografia computadorizada por feixe em leque	CT	Computed tomography
RM	Ressonância magnética	IRM	Imaging ressonance magnetic
TCFC	Tomografia computadorizada por feixe cônico	CBCT	Cone beam computed tomography
CD	Cirurgião-dentista	FOV	Field of view
FOV	Field of view	DICOM	Digital Imaging and communications in medicine
DICO	Digital Imaging and		
M	communications in medicine		

Lista de unidades de medida

kVp Quilovolt pico

mA miliampère

Resumo

A utilização do exame de tomografia computadorizada por feixe cônico (TCFC) tem aumentado muito nos últimos anos na Odontologia, com isso, muito se discute sobre o papel do cirurgião-dentista na avaliação de estruturas anatômicas próximas ao complexo maxilo-mandibular. Atualmente não se conhece a ocorrência de anormalidades nos seios maxilares em uma grande amostra de exames de TCFC de pacientes com diferentes indicações odontológicas. O objetivo deste estudo foi investigar: 1-ocorrência de

anormalidades no seio maxilar por meio de exames de TCFC de pacientes assintomáticos, 2-identificar a frequência, tipo e localização destas anormalidades, e 3- sua associação com a proximidade de lesões periapicais e alterações inflamatórias detectadas no seio maxilar. 1113 exames de TCFC foram avaliados por dois examinadores para identificar a presença ou ausência de anormalidades do seio maxilar. Os casos com anormalidades foram reavaliados para a identificação do tipo de anormalidade e localização no interior da cavidade sinusal. A presença e a proximidade das lesões periapicais em dentes superiores posteriores à parede inferior do seio foram registrados. Os dados foram analisados por estatística descritiva e teste do qui-quadrado. A concordância entre os examinadores foi calculada por meio da estatística Kappa. Anormalidades foram diagnosticadas em 760 pacientes (68,2%) (kappa 0,83 coeficiente). Houve diferença significativa entre os sexos, com maior ocorrência no gênero masculino ($p < 0,001$). Não houve diferença na ocorrência de anormalidades em relação às faixas etárias ($p < 0,05$). Espessamento mucoso foi a alteração mais prevalente (66%), seguido de cisto de retenção (10,1%) e opacificação (7,8%). As localizações mais frequentes de anormalidades sinusais foram na parede inferior (46,2%), anterior (29%), média (25,7%) e parede lateral (21,5%). Não foi observada associação entre a proximidade da lesão periapical e presença e tipo de anormalidades inflamatórias ($p = 0,124$). A ocorrência de anormalidades no seio maxilar de assintomáticos foi considerada alta. Estes achados enfatizam a importância de uma interpretação abrangente pelo radiologista dentomaxillofacial de todo o volume de imagens de TCFC, incluindo todo o seio maxilar, como parte do exame de imagem dos pacientes de rotina.

Palavras chave: Seios maxilares, tomografia computadorizada por feixe cônico, achados incidentais, anormalidades.

Abstract

The use of cone beam computed tomography exam (CBCT) has increased greatly in recent years in dentistry, so there is much discussion about the role of the dentist in evaluating the anatomical structures near the maxillo-mandibular. Currently we do not know the occurrence of abnormalities in the maxillary sinuses in a large sample of CBCT examinations of dental patients with different indications. The aim of this study was 1-to investigate the occurrence of

maxillary sinus abnormalities using cone beam computed tomography (CBCT) exams of asymptomatic patients, 2- identify the frequency, type and location of these findings, and 3- its association with the proximity of periapical lesions and inflammatory changes in the maxillary sinus. 1113 CBCT exams were evaluated by two examiners to identify the presence or absence of abnormalities of the maxillary sinus. Cases with abnormalities were reevaluated for identification of the type of the abnormality and location within the sinus. The presence and proximity of periapical lesions in the upper posterior teeth to the lower sinus wall were recorded. Data were analyzed using descriptive statistics and chi-square test. Inter-rater agreement was calculated using Kappa statistics. Abnormalities were diagnosed in 760 (68.2%) cases (kappa coefficient 0.83). There was a significant difference between genders, showing greater occurrence in males ($p < 0.001$). No difference in the occurrence of abnormalities was observed regarding age groups ($p > 0.05$). Mucosal thickening was the most prevalent abnormality (66%), followed by retention cyst (10.1%) and opacification (7.8%). The most frequent location of sinus abnormalities were in the inferior wall (46.2%), anterior (29%), medial (25.7%) and lateral wall (21.5%). No association between the proximity of periapical lesion and the presence and type of inflammatory abnormalities was observed ($p = 0.124$). The occurrence of abnormalities in maxillary sinus of asymptomatic was considered high. These findings emphasize the importance of a comprehensive interpretation by the dentomaxillofacial radiologist of all volume of CBCT images, including the entire maxillary sinus as part of the imaging exam of routine patients.

Keywords: Maxillary sinus, cone beam computed tomography, incidental findings, abnormalities

1. Introdução e Caracterização do problema

O seio maxilar (SM) é o maior dos seios paranasais que incluem também os seios frontal, etmoidal e esfenoidal. Em geral o SM é bilateral e são cavidades pneumáticas, delineadas por osso cortical e revestidas por epitélio respiratório. Estão localizados no interior do osso da maxila tendo forma de pirâmide.^{17,26} Os SMs crescem após o nascimento até cerca de 3 anos de idade e depois progride lentamente até os 7anos, após essa idade há outra aceleração do crescimento atingindo seu tamanho máximo por volta dos 12 a 14 anos de idade, que corresponde à época do final da erupção dos dentes permanentes e do crescimento do processo alveolar da maxila. O tamanho do SM varia substancialmente de indivíduo para indivíduo, tendo também variações entre os antímeros direito e esquerdo em um mesmo indivíduo.^{18,30}

Algumas alterações durante a vida, como perdas dentárias podem levar à pneumatização ou expansão desses seios, sendo que grandes expansões para o interior do processo alveolar podem deixar apenas uma fina camada de osso alveolar entre o seio e a cavidade oral. Em indivíduos dentados expansões contínuas podem deslocar o soalho do seio através das raízes dos dentes superiores posteriores.^{5,18} Os dentes pré-molares e molares estão situados abaixo do soalho do SM. O primeiro pré-molar normalmente não

possui íntima relação com o soalho do SM, sendo a relação do segundo pré-molar mais evidente. As raízes dos molares superiores possuem íntima relação com o SM, especialmente do segundo molar, além disso, a divergência dessas raízes permite uma extensão do seio em direção ao processo alveolar.^{5,10,11,18,} A média de distância dos molares e pré-molares superiores ao soalho do SM varia de 0,83mm para a raiz mésio-vestibular do segundo molar a 7,05mm para a raiz palatal do primeiro pré-molar⁷ portanto na região do segundo molar há menor quantidade de osso.

Exames radiográficos convencionais têm sido utilizados para avaliar alterações nos SMs. A técnica radiográfica pósterio-anterior do seio maxilar ou técnica de Waters é uma projeção comumente utilizada para observar os SMs. Nos exames convencionais os SMs normais aparecem como radiolúcidos delimitados por uma fina e delicada linha radiopaca, que constitui a cortical óssea que o delimita.²⁶

Em radiografias intra-orais como nas periapicais de dentes posteriores superiores é possível observar a relação do soalho do SM com os dentes. Já as radiografias extra-orais fornecem uma imagem de uma área maior do SM e possibilitam a comparação com o do lado oposto. A radiografia panorâmica, por exemplo, é uma radiografia rotineiramente solicitada pelo cirurgião-dentista (CD), apesar de não ter indicação específica para avaliação dos SMs, esta técnica permite visualizar a parede inferior e posterior, apesar da sobreposição das conchas nasais, do osso e processo zigomático e do palato duro sobre esta área anatômica.^{18,26}

A Tomografia Computadorizada de feixe em leque (TC) empregada desde 1970 na área médica com finalidade diagnóstica, constitui uma modalidade de exame por imagem que propicia a avaliação do SM e de estruturas adjacentes, permitindo visualizar osso e tecido mole em cortes seccionais eliminando a sobreposição de outras estruturas, além de possibilitar obter imagens reconstruídas tridimensionalmente.^{2,18} O Royal College of Radiologists Working Party recomenda a TC para exame dos SMs como técnica especializada capaz de fornecer mais informações do que as técnicas convencionais, sendo útil para demonstrar a presença e distribuição de doenças sinusais e fornecer melhor avaliação anatômica. Entretanto, recomenda o uso de técnicas com baixa dose de radiação antes de indicar a TC.²³

Na TC os SMs são estruturas que apresentam baixa densidade por isso aparecem como imagens enegrecidas chamadas de hipodensas. O aspecto tomográfico de um SM saudável é hipodenso, pois não possui a capacidade de atenuar os feixes de raios X. Já a cortical que delimita o seio é observada como uma imagem hiperdensa ou branca, indicando a atenuação dos raios X.¹

Os SMs podem, muitas vezes, ser acometidos por anormalidades comumente observadas em exames radiográficos de rotina, algumas vezes, sem sintomatologia. Devido a este fato, são denominados achados incidentais, pois não se relacionam ao propósito do exame.⁴

Exames convencionais podem estimar a prevalência de anormalidades nos seios maxilares. Em uma amostra populacional na Finlândia observou-se

12% de espessamento mucoso no seio maxilar, e 7% de cisto de retenção de muco observando ainda a relação de lesões nos dentes superiores posteriores com espessamento mucoso.²⁷

Há estudos específicos que utilizaram a TC para observar a prevalência de anormalidades nos seios paranasais. Em uma avaliação de exames de TC em pacientes pediátricos sem indicações sinusais, Diament, Senac, Gilsanz et al (1987) observaram que metade dos pacientes menores que 13 anos apresentavam algum grau de opacificação nos SMs e etmoidais.⁶ Em um estudo similar, Lesserson, Kieserman, Finn (1994) encontraram 39% de opacificação nos SMs nas TC avaliadas.¹³ Havas, Motbey, Gullane (1988) investigando anormalidades nos seios paranasais em TC de pacientes adultos assintomáticos detectaram 42,5% de alterações nos seios paranasais, sendo que o SM foi o que apresentou a segunda maior prevalência de anormalidades.⁹ Na avaliação dos exames de TC para seios paranasais é importante estabelecer a correlação de achados clínicos com os radiográficos antes do estabelecimento do diagnóstico.^{6,9}

Com o objetivo de investigar a relação dos dentes superiores com alterações nos SMs, Yoshiura et al (1993) utilizaram exames de TC para diferenciar sinusite de origem dentária de sinusite originada do próprio epitélio sinusal. Foram avaliados parâmetros como tipo de espessamento mucoso, presença de inflamação, espessamento ou esclerose das paredes sinusais e diminuição no tamanho do SM. A sinusite de origem dentária pôde ser diferenciada de outra sinusite principalmente pela presença de periodontite

apical em dentes próximos ao SM.³¹ Outro exame por imagem utilizado para avaliação dos seios paranasais é a ressonância magnética (RM). Estudo observou prevalência de 32,3% de anormalidades nos seios paranasais.¹⁴

Dentre os exames recentes de diagnóstico por imagem, a tomografia computadorizada por feixe cônico (TCFC) tem conseguido grande aceitação nas diversas áreas da Odontologia durante os últimos anos, auxiliando no diagnóstico e no plano de tratamento nas diversas especialidades. A TCFC possui um sistema tubo-detector que realiza um giro de 180 a 360 graus ao redor da cabeça do paciente obtendo-se assim uma imagem volumétrica 3D que pode ser utilizada para fornecer as imagens nos planos axial, coronal e sagital.^{15,24-25,28-29}

Os aparelhos de TCFC são, em geral, relativamente menores do que os de TC semelhantes a um aparelho de raios X panorâmico, com tubos de raios X de menor custo e possuem sistemas de detectores de imagem de alta qualidade acoplados a sistemas computacionais e softwares. As principais contribuições desse exame estão relacionadas à sua alta resolução, que permite avaliar com precisão o relacionamento entre as estruturas anatômicas, à redução substancial da área irradiada, com colimação do feixe de raios X primário na área de interesse, proporcionando uma menor dose de radiação em comparação ao exame de TC, portanto melhor custo/benefício.^{2,15,24,25,28}

Utilizando o exame de TCFC de pacientes com indicação ortodôntica, Cha, Mah, Sinclair (2007) observaram achados incidentais nos espaços aéreos da região maxilofacial, articulação temporomandibular e achados endodônticos.

Eles encontraram que em 24,6% da amostra havia alterações nessas regiões sendo que 18,2% possuíam alterações nos espaços aéreos.⁴ Em outro estudo os achados incidentais nos SM de pacientes com indicação ortodôntica totalizaram 46,8% da amostra, incluindo doenças alérgicas, inflamatória aguda e crônica.²²

Sendo o exame de TCFC considerado o maior avanço dos últimos anos, em termos de diagnóstico por imagem na Odontologia, e com sua crescente indicação em diversas especialidades Odontológicas, muito tem se questionado sobre o papel do CD na avaliação da imagem obtida no exame. Atualmente em todos os continentes tem sido discutida a responsabilidade do profissional na interpretação de todo volume obtido, por isso é necessário o conhecimento para interpretar não só o complexo dento-maxilar, mas também das estruturas adjacentes e dentre elas os SMs.^{2,3} Como os dentes superiores posteriores possuem íntima relação com os SMs, o CD tem ainda a possibilidade e responsabilidade de interpretar muitas anormalidades envolvendo os seios maxilares, que por vezes podem estar relacionadas a causas odontogênicas.¹⁹

No Brasil, ainda não há um consenso sobre a utilização desta tecnologia, assim como não há critérios bem definidos para o seu emprego na prática clínica do CD especializado em Radiologia e Imaginologia Odontológica. Embora de maneira informal tenha sido discutido nos fóruns científicos americanos ainda não há uma diretriz estabelecendo os critérios e restrições da prescrição e o papel do cirurgião-dentista na interpretação do volume obtido

por este método de exame. No continente Europeu recentemente foi aprovado um guia para orientar a utilização desta modalidade de imagem e os critérios para sua prescrição e interpretação na área odontológica⁸, no entanto, muito se tem a conhecer sobre prescrição e interpretação do volume de imagem em TCFC. Atualmente, não se conhece a prevalência de anormalidades em uma grande amostra de exames de TCFC de pacientes com diferentes indicações odontológicas.

2. Objetivos

Objetivo geral:

Detectar por meio de exames obtidos por tomografia computadorizada por feixe cônico as alterações da normalidade congênitas ou adquiridas freqüente nos seios maxilares em pacientes assintomáticos.

Objetivos específicos:

- 1- Avaliar a prevalência destas alterações relacionando-as a dados demográficos como gênero, idade, ocorrência uni ou bilateral e localização anatômica dentro do seio maxilar.
- 2- Classificar as alterações da normalidade de acordo a natureza das alterações podendo estas ser: congênitas, inflamatórias, odontogênicas, relacionadas ao osso, neoplásicas, iatrogênicas e sistêmicas.
- 3- Sugerir a possível associação das lesões com base na interpretação tomográfica e relação do soalho do seio maxilar com lesão periapical.
- 4- Verificar a concordância na interpretação de imagens do seio maxilar em exames de TCFC.

3. Materiais e métodos

3.1. Seleção dos pacientes

O presente trabalho foi aprovado pelo Comitê de ética em pesquisa da Universidade Federal de Goiás sob o protocolo de número 160/2010 (Anexo 1).

Esta pesquisa foi um estudo transversal e compreendeu uma amostra de 1113 exames de TCFC da maxila, realizados no período de Novembro de 2006 a Dezembro de 2008, provenientes do arquivo de uma clínica privada especializada em TCFC da cidade de Goiânia-GO, obtidos a partir da prescrição com variadas finalidades de investigação odontológica, tais como: Implantodontia, Cirurgia, Estomatologia, Ortodontia, Endodontia e Traumatologia. Nenhum paciente realizou o exame de TCFC por qualquer indicação de sinais e sintomas de doenças sinusais.

Foram incluídos na amostra exames de pacientes tanto do gênero masculino quanto feminino que fosse possível avaliar todo o SM ou pelo menos quatro paredes que o delimita, independente da observação da arquitetura óssea da maxila e de outras estruturas anatômicas. Como critérios de exclusão estão os pacientes menores de 12 anos por não apresentarem formação completa dos seios maxilares, imagens que não permitiam a visualização de pelo menos quatro paredes dos seios maxilares, exames com baixa resolução e/ou com presença de artefatos metálicos que impossibilitavam a visualização dos SM.

3.2 Obtenção e visualização das imagens

Todas as imagens foram obtidas em um aparelho i-Cat (Imaging Sciences International, Hatfield, PA, USA). Os parâmetros operacionais foram: FOV de 6cm, 8cm ou 13cm, voxel de 0,25x0,25x0,25mm. A voltagem do tubo era de 120kVp e a corrente de tubo de 3,8mA, tempo de exposição de 40 segundos.

Inicialmente foi realizado um estudo piloto utilizando 10% das imagens de TCFC da maxila para verificar a viabilidade da utilização de um software para a visualização dinâmica das imagens, que permitisse a manipulação do volume com cortes axiais, coronal e sagital da região de interesse do estudo. Concomitante a esta fase inicial foi elaborado o formulário para coleta de dados que foi utilizado durante o estudo (Apêndice 1) e calibração dos examinadores quanto aos critérios a serem observados durante o processo de avaliação das imagens.

O software escolhido para avaliar as imagens foi o ImageJ (ImageJ 1.37v, National Institute of Health, Bethesda, MD, USA) um software de processamento de imagens que é capaz de reconstruir imagens volumétricas no formato DICOM. Este software permite visualizar imagens nos vários cortes seccionais básicos. Para a leitura do volume de imagens dos exames de TCFC pelo software ImageJ foi necessário a transformação do arquivo, utilizando o software integrado ao aparelho I-Cat (Xoran version 3.1.62; Xoran Technologies, Ann Arbor, MI, USA), para o formato DICOM que pode ser lido

no software utilizado pelo estudo. Uma razão importante para escolha deste software é por ser de domínio público, reconhecer o formato DICOM e ser utilizado para fins de pesquisa com arquivos deste formato. As ferramentas de ampliação e medição foram utilizados quando necessário.

A estação de trabalho utilizada foi um PC Microsoft Windows XP Professional SP-2 (Microsoft Corporation, Redmond, WA, EUA), com processador Intel® Core™ 2 Duo 6300 1,86 GHz (Intel Corporation, Santa Clara, CA, EUA), NVIDIA GeForce 6200 placa de video turbo cache (NVIDIA Corporation, Santa Clara, CA, EUA) e EIZO - Flexscan S2000 monitor com 1600 x 1200 pixels de resolução (Eizo Nanao Corporation, Hakusan, Japan).

3.3 Intepretação das imagens

As imagens de TCFC foram analisadas por dois examinadores independentes entre si, sendo ambos especialistas em Radiologia Odontológica. A calibração foi feita durante o projeto piloto.

O processo de avaliação foi dividido em duas fases. Na primeira fase os examinadores avaliaram a existência ou não de anormalidades nos SMs e assinalaram em planilha específica do formulário de dados “SIM”(1) quando detectada anormalidade no SM e “NÃO”(0) no caso de ausência. Nos casos considerados positivos o examinador deveria determinar o lado da anormalidade, se direito e/ou esquerdo. Nos casos que foram detectados mais de um exame por paciente em épocas diferentes da pesquisa foi considerado apenas o primeiro exame avaliado.

O critério “SIM” que determinava a presença de anormalidade dos SMs foram considerados os seguintes critérios:

- 1) SMs que possuíam dimensão aumentada ou diminuída;
- 2) SMs que possuíam espessamento da mucosa do SM superior ou igual a 3mm;
- 3) SMs que possuíam alteração na densidade radiográfica no interior ou na cortical que o delimita;
- 4) Opacificação parcial ou total do SM.

Os exames que foram considerados como “NÃO” para anormalidade pelos dois examinadores, foram avaliados por um terceiro examinador para certificação do verdadeiro negativo.

Além da presença ou não de anormalidade nos SMs foram registrados dados referentes à indicação do exame, gênero e idade dos indivíduos submetidos ao exame tomográfico.

O objetivo, portanto, dessa primeira etapa foi selecionar os pacientes que possuíam anormalidades nos SMs, determinando se eram ausentes, unilaterais ou bilaterais. Os exames que foram considerados com algum tipo de anormalidade por pelo menos um examinador foram incluídos na amostra da segunda etapa. É importante ressaltar que os casos considerados ausentes por ambos examinadores foram excluídos da amostra.

Na segunda fase do processo de avaliação foram selecionados somente aqueles exames determinados como “SIM” no item anormalidade indicados na primeira fase por pelo menos um dos examinadores. Quando o arquivo da

imagem não permitia classificação adequada da lesão no seio maxilar, a imagem era excluída da amostra.

Para facilitar o armazenamento dos dados referente à detecção e classificação das alterações da normalidade o formulário de coleta de dados elaborado pelos pesquisadores foi automatizado para um formulário eletrônico. Realizou-se a classificação das lesões quanto à natureza das mesmas em congênita (aplasia e hipoplasia), neoplásica (benigna e maligna), odontogênica (tumor odontogênico benigno, cisto odontogênico e lesão inflamatória periapical), lesão relacionada ao osso (fibroma ossificante, displasia fibrosa e doença de Paget), traumática (fratura), iatrogênica (lesões relacionadas à procedimentos cirúrgicos), inflamatória (espessamento mucoso, opacificação, pólipos, cisto de retenção de muco, antrolito), sistêmico e síndrome do seio silenciosos.^{12,16,19} Os dados foram coletados pelos dois examinadores e divergências foram solucionadas por consenso.

Baseado na sua localização e extensão dentro do SM, as lesões foram classificadas como: anterior (A), posterior (P), superior (S), inferior (I), medial(M) e lateral(L) e as seguintes combinações: posterior-superior (PS), posterior-inferior (PI), anterior-inferior (AI), anterior-posterior (AP), anterior-posterior-inferior (API) e anterior-posterior-superior (APS).²⁰ (Anexo 2)

Para as lesões de natureza inflamatória foi observada possível relação com causa odontogênica mediante avaliação de presença de lesão periapical e relação desta com a proximidade com o soalho do SM. Foi realizada uma classificação baseada na distância entre lesões periapicais e soalho do SM,

sendo: classe I quando há certa distância entre a lesão e o seio maxilar, classe II quando a lesão toca o soalho do seio; e classe III quando a lesão ultrapassa o soalho do seio, com base no estudo de OBERLI et al. (2007) (Anexo 3)²¹ A presença de lesão periapical nos dentes superiores posteriores era registrada quando a lâmina dura estava imperceptível ou irregular e quando havia uma radiolucidez indicando destruição óssea ao redor do ápice radicular. Nos casos de múltiplas lesões periapicais, considerava-se apenas a que estivesse mais próxima do soalho do SM. O registro das lesões periapicais foi realizado por apenas um examinador.

Para a análise dos dados foi realizada estatística descritiva e utilização do teste de X^2 . Além disso, foi utilizado o coeficiente Kappa para avaliação de concordância inter-examinadores. O software SPSS 17.0 software (SPSS Inc., Chicago, IL) foi utilizado para análise dos dados.

4. Publicação

Título do artigo:

**OCCURRENCE OF MAXILLARY SINUS ABNORMALITIES DETECTED BY
CONE BEAM CT IN AN ASYMPTOMATIC PATIENT SAMPLE**

Formatação da publicação seguindo as normas da revista Dentomaxillofacial Radiology (Anexo 4).

**OCCURRENCE OF MAXILLARY SINUS ABNORMALITIES
DETECTED BY CONE BEAM CT IN AN ASYMPTOMATIC
PATIENT**

OCCURRENCE OF MAXILLARY SINUS ABNORMALITIES DETECTED BY CONE BEAM CT IN AN ASYMPTOMATIC PATIENT

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Running title: Maxillary sinus in CBCT

Abstract

Objectives: The aim of this study was to investigate the occurrence, type and location of maxillary sinus abnormalities in asymptomatic patients by using cone beam computed tomography (CBCT) exams. The association with the proximity of periapical lesions and inflammatory changes in the maxillary sinus (MS) were recorded. **Methods:** To identify the presence or absence of abnormalities of the maxillary sinus, 1113 CBCT exams were evaluated by two examiners. The presence of periapical lesions in the upper posterior teeth and their proximity to the lower sinus wall was recorded. Data were analyzed using descriptive statistics and the chi-square tests. The inter-rater agreement was calculated using Kappa statistics. **Results:** Abnormalities were diagnosed in 760 (68.2%) of cases (kappa coefficient 0.83). There was a significant difference between the genders, while the largest occurrence was shown in males ($p < 0.001$). There was no difference in the occurrence of abnormalities in the various age groups ($p > 0.05$). Mucosal thickening was the most prevalent abnormality (66%), followed by retention cysts (10.1%) and opacification (7.8%). Sinus abnormalities occurred with the following frequency in the inferior (46.2%), anterior (29%), medial (25.7%) and lateral walls (21.5%). No association was observed between the proximity of periapical lesions and the presence and type of inflammatory abnormalities ($p = 0.124$). **Conclusions:** The occurrence of maxillary sinus abnormalities in asymptomatic patients was considered high. These findings emphasize how important it is for the dentomaxillofacial

radiologist to undertake a comprehensive interpretation of the whole volume of CBCT images, including the entire maxillary sinus.

Keywords: Maxillary sinus, cone beam computed tomography, abnormality

Introduction

The multiplanar images acquired by cone beam computed tomography (CBCT) provide an opportunity for radiologists to inspect the entire volume of the acquired image and the anatomic variations and abnormalities that can be found in the image volume¹ but this responsibility is frequently neglected when interpreting images of areas at a distance from the dentoalveolar region, such as the full anatomical aspect of the maxillary sinus (MS).^{1,2}

Incidental abnormalities of the maxillary sinus are common findings in spiral computed tomography (CT) scans³⁻⁶ and CBCT dental scans⁷⁻⁸ In a study using CBCT examinations, the abnormalities found were signs of acute sinusitis (7.5%), retention cysts (3.5%), and polypoid mucosal thickening (2.3%)⁷ and in another study flat mucosal thickening (23.7%), polypoid mucosal thickening (19.4%) and signs of acute sinusitis (3.6%) were found.⁸

Failure to detect incidental abnormalities is associated with the oral radiologists' limited ability and experience when interpreting volumetric images and their negligence when undertaking a systematic visual scrutiny of the whole

image, including the dentoalveolar region and all adjacent structures of the maxillomandibular complex.¹⁻² Volumetric images of the maxilla allow for visualization of the entire acquired image volume¹ and the intimate relationship between the upper posterior teeth and the maxillary sinuses as well as the occurrence of certain sinus changes, which are sometimes related to odontogenic causes.⁹

Although previous studies reported the occurrence of incidental abnormalities in CBCT scans in patients referred to as orthodontic and other dental purposes⁷⁻⁸, the prevalence of abnormalities is not known in large samples of scans of patients who underwent the exam for different oral and dental diagnostic purposes. The aim of this study was to investigate the occurrence of maxillary sinus abnormalities in CBCT exams, identify the frequency, type and location of these findings, and the correlation between the distance of periapical lesions and inflammatory changes in the maxillary sinus.

Materials and Methods

The study sample comprises 1113 consecutive records of CBCT tests undertaken at a private radiological clinic in Goiânia, Goiás, Brazil, between November 2006 and December 2008. All the patients had been referred for CBCT diagnosis and treatment planning, which included dental implants, maxillofacial surgery, orthodontics, endodontics, oral pathology, etc.. No patient

had been primarily referred for a CT scan of the maxillary sinus area because of sinus symptoms or suspected diseases.

All CBCT exams which showed the entire maxillary sinuses bilaterally or at least the four sinus walls were included in the study sample, independently of whether the whole maxilla and other anatomical structures were visualized or not. Patients under 12 years old were excluded because of their incomplete sinus development. Images of low resolution quality and/or those in which the presence of metallic artifacts impaired sinus visualization were also excluded.

All CBCT images were taken using the I-CAT Cone Beam 3D imaging system (Imaging Sciences International, Hatfield, PA, USA) using small FOV (6 cm, 8cm or 13cm). Image volume was reconstructed with isotropic-isometric 0.25 x 0.25 x 0.25 mm voxels. The tube voltage was 120 KVp, tube current was 3.8mA, and an exposure time of 40 seconds was used.

Images were stored and converted into DICOM file format using the acquisition software integrated to the CBCT machine (Xoran, version3.1.62; Xoran Technologies, Ann Arbor, MI, USA). The imported DICOM files were opened and examined using the ImageJ software (ImageJ 1.37v, National Institute of Health, Bethesda, MD, USA). Diagnosis of the maxillary sinuses was performed on a 1:1 scale, using three orthogonal slice views (axial, coronal and sagittal). The PC workstation used the Windows® 7 Home Premium 64-bit (Microsoft Corporation, Redmond, WA, USA), with AMD Processor Phenom™ II X4 P960 Quad Core (1.8GHz, 2MB Cache) (Advanced Micro Devices,

Sunnyvale, CA, USA), ATI Radeon HD5450 video card (AMD Graphics Products group, Sunnyvale, CA, USA) and LG E1950T LED LCD Monitor 18,5" screen size 1360 x 768 pixels (LG Electronics, Seoul, South Korea). ImageJ measuring tools were used to measure mucosal thickening.

The CBCT scans were analyzed by two independent, experienced oral radiologists. The examiners were trained and calibrated using 10% of the sample in a pilot study before data collection began.

A screening procedure was undertaken to identify the presence or absence of sinus abnormalities using a yes/no scale, and orthogonal views of coronal, axial and sagittal scans. The criteria to classify the presence of an abnormality included the identification of at least one of the following deviations from normality: (1) increased or decreased dimension of the sinus, (2) radiographic density changes in the cortical bone of the sinus, (3) partial or complete opacification of the sinus cavity, and (4) increased thickening of the mucosa greater than 3mm. The screening procedure classified cases as having a sinus abnormality when both examiners identified at least one type of abnormality, and excluded cases in which both examiners diagnosed the absence of an abnormality. In order to minimize the occurrence of false negative cases in the screening stage, cases were not excluded from the sample when disagreements occurred between the examiners. The identification of an abnormality was registered separately for the right and left sinuses of each patient.

In the next step, selected cases were independently re-evaluated by the two examiners in order to diagnose and classify the cases into different abnormality subtypes, such as congenital changes (aplasia and hypoplasia), malignant and benign tumours, odontogenic lesions (benign odontogenic tumours and inflammatory and odontogenic cysts), bone-related lesions (ossifying fibroma, fibrous dysplasia and Paget's disease), traumatic lesions (bony fracture), iatrogenic lesions (lesions associated with surgical procedures), inflammatory lesions (mucosal thickening, retention cysts, opacification, sinus polyps and antrolith), systemic diseases which affect the sinus region, and the silent sinus syndrome disease.¹⁰⁻¹² Data were gathered and divergences between the examiners were solved by reaching a consensus.

The locations of the diagnosed abnormalities were also recorded as affecting either the anterior, posterior, upper, lower, lateral and/or medial walls of the sinus (Figure 1) and they were classified on based on the method of Nishimura & Iizuka (2002).¹³ When the stored file did not allow for an acceptable view of the entire sinus volume, then that case was excluded from the sample.

The presence of periapical lesions in the upper posterior teeth was recorded and proximity of the lesions to the lower sinus wall was classified using the proposal of Oberli et al. (2007): class I (near to the sinus floor), class II (in contact with the sinus floor) and class III (overlapping the sinus floor).¹⁴ The presence of a periapical lesion was recorded when the lamina dura was imperceptible or had an irregular appearance, and when there was a

radiolucency indicating bone destruction around the root apex. In cases of multiple periapical lesions near the sinuses, only the most closely related to the sinus was recorded. The assessment of the periapical lesions was performed by only one examiner.

The data were analysed using descriptive statistics and the chi-square tests. The inter-rater agreement was calculated using Kappa statistics. SPSS 17.0 software (SPSS Inc., Chicago, IL) was used for the data analysis.

Results

The CBCT exams of 1113 patients were included in the sample, 678 (60.9%) of which were female and 435 (39.1%) male. Their ages ranged from 12 to 85 years (mean = 49.0; SD = 15.0). The exams had been undertaken for diagnostic purposes, such as implant planning (69.2%), endodontic exam (16%), surgical planning (8.3%), oral disease diagnosis (3.5%), TMJ dysfunction (1.0%), orthodontic diagnosis (0.9%), and traumatology (0.7%).

The first radiologist detected sinus abnormalities in 688 exams (61.8%), while the second detected them in 745 (66.9%). Inter-rater agreement was 92.2% (31.7% without any abnormality and 60.5% with an abnormality) and the kappa coefficient was 0.83, which indicated an excellent degree of agreement in the identification of cases with and without abnormality. Agreement for the identification of abnormal sinuses (right and left sides) was 87.5%, and the

kappa coefficient was 0.75. There was a significant difference between the genders, showing a greater occurrence of sinus abnormalities in males: 71.5% versus 55.6% for examiner 1 and 73.8% versus 62.5% for examiner 2 ($p < 0.001$). No difference in the occurrence of abnormalities was observed with regard to the tercile of age groups ($p > 0.05$).

When both examiners concluded that there was no abnormality, a third radiologist was requested to confirm the true negative diagnosis at this screening stage. Such cases amounted to 353 (31.7%) and were excluded from the sample. The remaining cases were included because either both examiners ($n = 673$; 60.5%) or at least one ($n = 87$; 7.8%) detected some sinus abnormality.

The study sample after screening comprised 760 (68.3%) images with a suspicion of abnormality. At the next stage, 57 images were excluded due to metallic artifacts which result in image noise, thereby impairing visualization and upsetting the classification of the whole image. Thus the final sample size was made up of 703 images (1406 sinuses).

A comprehensive evaluation of the images with sinus abnormalities was performed by the two examiners. Of the 20 abnormalities types, the percentage agreement between the examiners was 53.6% ($n = 377$) for bilateral (right and left sides), 34.0% ($n = 239$) for unilateral, and there was complete disagreement in 12.4% ($n = 87$) of cases. After consensus, the frequency distribution of abnormalities was detailed in Table 1.

The location and extension of the abnormalities are schematically illustrated in figure 2 and table 2. The frequency distribution from highest to lowest were the inferior (46.2%), anterior (29%), medial (25.7%), lateral (21.5%), posterior (16.6%) and superior walls (5.9%).

Table 3 shows the cross tabulation between the classification of periapical lesions and three types of abnormality (mucosal thickening, opacification and retention cyst). The results showed that there was no difference in the distance of periapical lesion classification according to presence and type of inflammatory abnormality ($p=0.124$).

Discussion

MS abnormalities were highly prevalent in this sample of asymptomatic patients. These results emphasized the importance of exploring the entire volume of the CBCT image, including the MS and related areas, and how important it is to consider the whole clinical context when interpreting abnormalities.

It has been widely recognized that the introduction of the CBCT exam was one of the greatest advances in recent years in terms of diagnostic imaging in dentistry. However, an interpretation of CBCT images requires familiarity with the anatomy of the area under investigation, an understanding of the spatial relationships of the image volume, a sound knowledge of the possible diseases,

anatomical variations and abnormalities which affect the maxillofacial area and, finally, competence when formulating a differential diagnosis.^{1,2,15} These requirements are frequently overlooked and technical difficulties such as the lack of soft tissue contrast often lead to an inability to diagnose soft tissue abnormalities, thereby, increasing the vulnerability of oral-maxillofacial radiologists.²

A CBCT examination of the maxilla anatomy is commonly requested to evaluate the need of a surgical sinus lift for implant placement in the posterior maxilla. Incidental findings such as mucosal thickening can be associated with a sinus outflow obstruction which can impact on the clinician's treatment decisions.⁶ This abnormality is frequently investigated in exams for implant treatment planning, but other abnormalities are often overlooked.

Several studies have reported a great variability in the prevalence of incidental findings in the maxillary sinuses of asymptomatic subjects when multiplanar images are used. CT scanning studies found abnormalities in approximately 30% of cases^{3,4}, and CBCT studies reported a prevalence ranging from 24.6% to 46.8%.⁷⁻⁸ In our study, we detected incidental abnormalities in 68.3% of cases. Discrepancies in abnormality rates may be due to the influence of climate differences between geographical areas, dissimilarities in the sampling criteria, and variations in image interpretation and diagnostic criteria.^{3,5,17}

Sinus abnormalities were more frequently found in males ($p < 0.001$). Similar results were reported by Vallo et al (2011), who suggested that the latter are more vulnerable to the occurrence of mucosal thickening due to irritation of the sinus mucosa because of the greater prevalence of pathologic dental findings in males.¹⁸ We detected no influence of age on the occurrence of sinus abnormalities. While our sample covered a wide range of ages, it did not include patients under 12-years old because the formation of their MS is still incomplete and certain abnormalities such as mucosal thickening and opacification are common findings in early childhood and are not indicative of sinus disease.³

Mucosal thickening was the most frequently observed abnormality (66.0%). It is generally associated with some kind of irritation, such as odontogenic pathology or allergic phenomena.¹² Nonvital posterior maxillary teeth, periodontal abscesses, retained roots, embedded or impacted teeth, extensively carious teeth and oro-antral fistulae could be etiological factors in pathologies of odontogenic origin.¹⁸

Although odontogenic irritation may be potentially influenced by the proximity between roots with periapical lesions and the floor of the sinus,^{11,18,19} we did not find any significant association. In addition, there is no consensus in the literature on the amount of mucosal thickening considered abnormal. Previous studies have suggested measurements ranging from 2 to 6 millimeters.^{6,9,17-18,20-21} As we considered 3 mm as the reference measure, this

could also have influenced the high occurrence of mucosal thickening in our study.²¹

The lower sinus wall was the most affected location within the sinus, which would suggest a possible odontogenic involvement.²⁰ However, considering that the CBCT increases the accuracy of detecting periapical lesions²²⁻²³, these results should be interpreted with caution, since incipient and chronic periapical lesions detected by a CBCT exam might present low potential for evocating sinus inflammatory signs and symptoms. The low prevalence of abnormalities in the upper sinus wall may also have been influenced by the limited visualization of this region due to the small FOV (6 cm) commonly used for this examination.

Mucous retention cysts were the second most frequently found inflammatory abnormality (10.1%). This result is similar to other studies of general dental patients when plain panoramic radiography was used and a prevalence ranging from 1.4% to 9.6%²⁴⁻²⁶ was found. Other studies using sectional exams obtained by CT and MRI in which a prevalence of 12.4%²⁷ was found were also quite similar.

Opacification was observed in 7.8% of the exams, which would suggest an occurrence of sinusitis. However, sometimes opacification can also be found in abnormalities other than sinusitis, such as mechanical trauma, barotraumas and hemorrhage.¹² In addition, a final diagnosis of sinusitis may also be

considered when clinical signs and symptoms are present and such factors were not evaluated in this study.²⁸⁻²⁹

In conclusion, the high occurrence of abnormalities in asymptomatic MS emphasizes how important it is for the dentomaxillofacial radiologist to undertake a comprehensive interpretation of the whole volume acquired in CBCT images, including the entire MS when analyzing the imaging exams of routine patients. Incidental findings may be considered in the individual clinical context of signs and symptoms, reducing the risk of overestimation of the real impact of radiographic findings.

References

1. Carter L, Farman AG, Geist J, Scarfe WC, Angelopoulos C, Nair MK et al. American Academy of Oral and Maxillofacial Radiology Executive Opinion Statement on Performing and Interpreting Diagnostic Cone Beam Computed Tomography. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2008; 106:561-562.
2. Campbell PD, Zinreich SJR, Aygun N. Imaging of the paranasal sinuses and In-Office CT. *Otolaryngol Clin North Am* 2009; 42:753-764.
3. Diamant MJ, Senac MOJR, Gilsanz V, Baker S, Gillespie T, Larsson S. Prevalence of incidental paranasal sinuses opacification in pediatric patients: a CT study. *J Comput Assist Tomogr* 1987; 11:426-431.

4. Havas TE, Motbey JA, Gullane PJ. Prevalence of incidental abnormalities on computed tomographic scans of the paranasal sinuses. *Arch Otolaryngol Head Neck Surg* 1988; 114:856-859.
5. Lesserson JA, Kieserman SP, Fin DG. The radiographic incidence of chronic sinus disease in the pediatric population. *Laryngoscope* 1994; 104:159-166.
6. Carmeli G, Artzi Z, Kozlovsky A, Segev Y, Landsberg R. Antral computerized tomography pre-operative evaluation: relationship between mucosal thickening and maxillary sinus function. *Clin Oral Impl Res* 2011; 22:78-82.
7. Cha J-Y, 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. Pazera P, Bornstein MM, Pazera A, Sendi P, Katsaros C. Incidental maxillary sinus findings in orthodontic patients: a radiographic analysis using cone-beam computed tomography (CBCT). *Orthod Craniofac Res* 2011; 14:17-24.
9. Mehra P, Murad H. Maxillary sinus disease of odontogenic origin. *Otolaryngol Clin North Am* 2004; 37:347-364.
10. Lawson W, Patel ZM, Lin FY. The development and pathologic processes that influence maxillary sinus pneumatization. *Anat Rec* 2008; 291:1154-1163.
11. Mehra P, Jeong D. Maxillary sinusitis of odontogenic origin. *Curr Allergy Asthma Rep* 2009; 9:238-243.
12. Madani G, Beale TJ. Sinonasal inflammatory disease. *Semin Ultrasound CT MRI* 2009; 30:17-24.

13. Nishimura T, Iizuka T. Evaluation of the pathophysiology of odontogenic maxillary sinusitis using bone scintigraphy. *Int J Oral Maxillofac Surg* 2002; 31:389-396.
14. Oberli K, Bornstein MM, Von Arx T. Periapical surgery and the maxillary sinus: radiographic parameters for clinical outcome. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2007; 103: 848-853.
15. Scarfe WC, Farman AG, Sukovic P. Clinical applications of cone-beam computed tomography in dental practice. *J Can Dent Assoc* 2006; 72:75-79.
16. Bolger WE, Butzin CA, Parsons DS. Paranasal sinus bony anatomic variations and mucosal abnormalities: CT analysis for endoscopic sinus surgery. *Laryngoscope* 1991; 101:56-64.
17. Lim W-K, Ram B, Fasulakis S, Kane KJ. Incidental magnetic resonance image sinus abnormalities in asymptomatic Australian children. *J Laryngol Otol* 2003; 117: 969-972.
18. Vallo J, Taipale LS, Huuonen S, Soikkonen K, Norblad A. Prevalence of mucosal abnormalities of the maxillary sinus and their relationship to dental disease in panoramic radiography: results from the Health 2000 Health Examination Survey. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2010; 109:e80-e87.
19. Hauman CHJ, Chandler NP, Tong DC. Endodontic implications of the maxillary sinus: a review. *Int Endod J* 2002; 35:127-141.
20. Obayashi N, Arijji Y, Goto M, Izumi M, Naitoh M, Kurita K et al. Spread of odontogenic infection originating in the maxillary teeth: computerized

tomographic assessment. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2004; 98:223-231.

21. Gordts F, Clement PAR, Destryker B, Desprechins B, Kaufman L. Prevalence of sinusitis signs on MRI in a non-ENT paediatric population. *Rhinology* 1997; 35:154-157.

22. Lofthag-Hansen S, Huuonen S, Grondahl K, Grondahl HG. Limited cone-beam CT and intraoral radiography for the diagnosis of periapical pathology. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2007; 103:114-119.

23. Low KMT, Dula K, Burgin W, von Arx T. Comparison of periapical radiography and limited cone-beam tomography in posterior maxillary teeth referred for apical surgery. *J Endod* 2008;34:557-562.

24. Bósio JA, Tanaka O, Rovigatti E, Gruner SK. The incidence of maxillary sinus retention cysts in orthodontic patients. *World J Orthod* 2009; 10:e7-e8.

25. Rodrigues CD, Freire GF, Silva LB, Fonseca da Silveira MM, Estrela C. Prevalence and risk factors of mucous retention cysts in a Brazilian population. *Dentomaxillofac Radiol* 2009; 38:480-483.

26. Rhodus NL. The prevalence and clinical significance of maxillary sinus mucous retention cysts in a general clinic population. *Ear Nose Throat J* 1990; 69:82-87.

27. Bhattacharyya N. Do maxillary sinus retention cysts reflect obstructive sinus phenomena? *Arch Otolaryngol Head Neck Surg* 2000; 126:1369-1371.

28. Hansen JG, Lund E. The association between paranasal computerized tomography scans and symptoms and signs in a general practice population with acute maxillary sinusitis. *APMIS* 2010;119:44-48.
29. Mudgil SP, Wise SW, Hopper KD, Kasales CJ, Mauger D, Fornadley JA. Correlation between presumed sinusitis-induced pain and paranasal sinus computed tomographic findings. *Ann Allergy Asthma Immunol* 2002; 88:223-226.

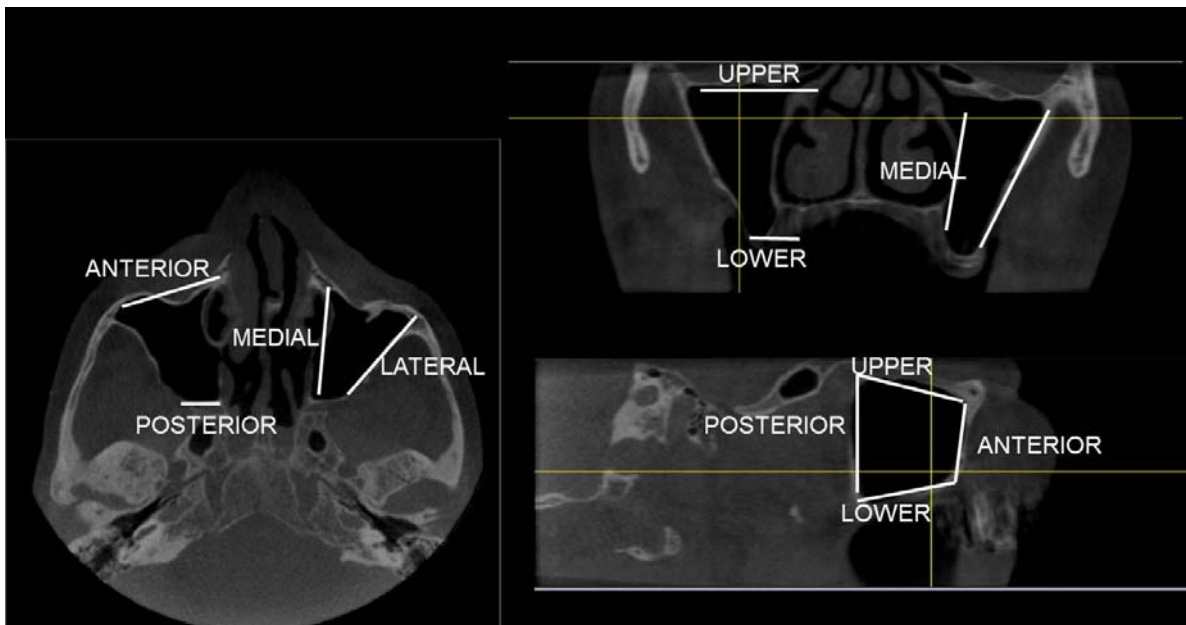


Figure 1: The locations of the abnormalities were recorded using orthogonal view of maxillary sinus.

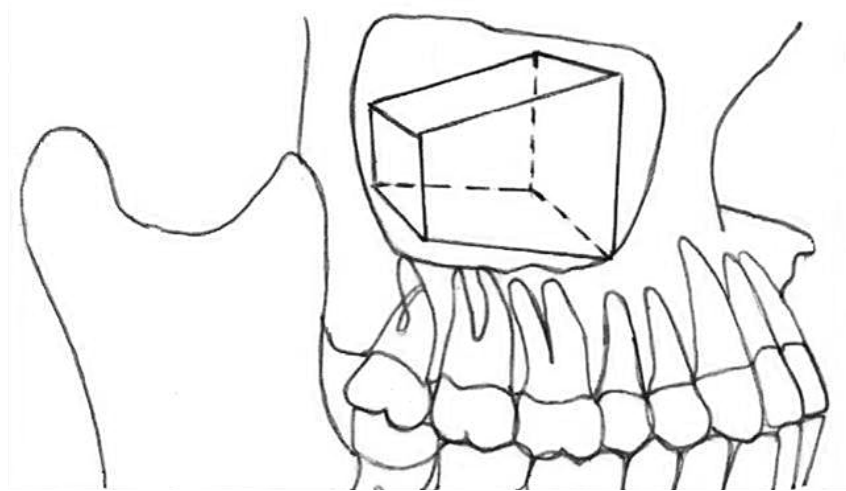














Figure 2. Schematic superposition of the geometric volume of the maxillary sinus and definition of sinus walls.

Table 1. Frequency distribution of sinusal abnormalities in images of 703 patients and 1406 sinuses (n=1268 lesions) - (percentage in parenthesis)

Type of abnormalities	Right side	Left side	Total
Inflammatory			
Mucosal thickening	422 (33.2%)	416 (32.8%)	838 (66.0%)
Retention cysts	49 (3.8%)	81 (6.3%)	130 (10.1%)
Opacification	54 (4.2%)	46 (3.6%)	100 (7.8%)
Sinus Polyps	49 (3.8%)	24 (1.8%)	73 (5.6%)
Antrolith	24 (1.8%)	19 (1.4%)	43 (3.2%)
Iatrogenic			
Oroantral communication	18 (1.4%)	11 (0.8%)	29 (2.2%)
Traumatic			
Fracture	10 (0.7%)	10 (0.7%)	20 (1.4%)
Neoplasia			
Malignant tumours	7 (0.5%)	7 (0.5%)	14 (1.0%)
Odontogenic lesions			
Inflammatory cysts	2 (0.2%)	3 (0.2%)	5 (0.4%)
Odontogenic cysts	2 (0.2%)	2 (0.2%)	4 (0.3%)
Benign odontogenic tumours	3 (0.2%)	1 (0.1%)	4 (0.3%)
Congenital			
Hypoplasia	-	3 (0.2%)	3 (0.2%)
Bone-related lesions			

Fibrous dysplasia	2 (0.2%)	1 (0.1%)	3 (0.2%)
Ossifying fibroma	1 (0.1%)	1 (0.1%)	2 (0.2%)

Table 2. Distribution of wall location of abnormalities within the geometric volume of the sinus (n=2118).

Sinuses	Wall locations*											
												
	(M)	(I)	(L)	(AI)	(API)	(APS)	(PI)	(S)	(AS)	(P)	(A)	(PS)
Right	277	226	229	129	118	56	8	7	5	0	0	0
Left	269	239	226	146	102	50	10	5	3	8	5	0
Total	546	465	455	275	220	106	18	12	8	8	5	0
%	25.8	22.0	21.5	13.0	10.3	5.0	0.8	0.6	0.4	0.4	0.2	0

* Location of the abnormalities within the sinus: M – medial wall, L – lateral wall, I – inferior wall, S- superior wall, A – anterior wall, P – posterior wall, AI – anterior and inferior wall, AS – anterior and superior wall, PS – posterior and superior wall, PI – posterior and inferior wall, APS – anterior, posterior and superior wall, API – anterior, posterior and inferior wall.

Table 3. Frequency of periapical lesion classification of proximity of the sinus inferior wall and type of inflammatory abnormalities (percentage in parenthesis)

Abnormalities	Classification			Total
	Class I	Class II	Class III	
None	10 (19.2)	21 (40.4)	21 (40.4)	52 (100)
Mucosal thickening	26 (19.3)	48 (35.6)	61 (45.2)	135 (100)
Opacification	-	7 (87.5)	1 (12.5)	8 (100)
Retention cyst	3 (15)	6 (30.0)	11 (55.0)	20 (100)
Total	39	82	94	215

p=0.124 (Chi-square test)

5. Considerações finais

Os resultados desta pesquisa detectaram uma alta ocorrência de anormalidades nos seios maxilares utilizando imagens obtidas através TCFC realizada para diversas indicações em pacientes assintomáticos. Além disso, observam-se as lesões inflamatórias como mais prevalentes e o soalho do seio maxilar como localização mais comum para as anormalidades. Não foi possível estabelecer relação da proximidade de lesões periapicais com o soalho do seio maxilar com presença e tipo de anormalidade.

A partir dos resultados obtidos no estudo, podemos ressaltar que é importante a avaliação no exame por TCFC de todo o volume obtido, incluindo áreas anatômicas relacionadas ao complexo maxilo-mandibular, dentre elas, o SM. No Brasil, ainda não existem diretrizes sobre interpretação do exame de TCFC por parte do Cirurgião Dentista e mesmo quaisquer restrições quanto à sua utilização na prática clínica. Diante disto, muito se tem a conhecer e discutir sobre as alterações da normalidade em áreas contíguas ao complexo dento-maxilo-facial, em especial os SM, que comumente são visualizados nos exames obtidos por TCFC quando adquirido o volume da maxila.

Torna-se importante aqui ressaltar que os achados radiográficos incidentais nos SM devem ser considerados independentes da finalidade do exame com indicação específica para área odontológica. Após, detectadas estas alterações questionamentos quanto aos aspectos sintomatológicos

devem ser realizados e o paciente ser encaminhado para o profissional da área específica do conhecimento da região sinusal.

6. Referências

1. ANGELOPOULOS, C. Cone beam tomographic imaging anatomy of the maxillofacial region. *Dent Clin N Am*, v. 52, n. 4, p. 731-52, 2008.
2. CAMPBELL, P.D.; ZINREICH, S.J.; AYGUN, N. Imaging of the paranasal sinuses and In-Office CT. *Otolaryngol Clin N Am*, v. 42, n. 5, p.753-64, 2009.
3. CARTER, L.; FARMAN, A.G.; GEIST, J. et al. American Academy of Oral and Maxillofacial Radiology Executive Opinion Statement on Performing and Interpreting Diagnostic Cone Beam Computed Tomography. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*, v. 106, n. 4, p.561-2, 2008.
4. CHA, J-Y.; MAH, J.; SINCLAIR, P. Incidental findings in the maxillofacial area with 3-dimensional cone-beam imaging. *Am J Orthod Dentofacial Orthop*, v. 132, n. 1, p. 7-14, 2007.
5. DAWKINS, J. The maxillary sinus and its relationship to dental practice. *Aust Dent J*, v. 12, n. 6, p. 520-7, 1967.
6. DIAMENT, M.J.; SENAC, M.O.JR; GILSANZ, V. et al. Prevalence of incidental paranasal sinuses opacification in pediatric patients: a CT study. *Comput Assist Tomogr*, v. 11, n. 3, p. 426-31, 1987.
7. EBERHARDT, J.A.; TORABINEJAD, M.; CHRISTIANSEN E.L. A computed tomographic study of the distances between the maxillary sinus floor and the apices of the maxillary posterior teeth. *Oral Surg Oral Med Oral Pathol*, v. 73, n. 3, p. 345-6, 1992.

8. Guidance on the safe use of dental cone beam CT (Computed Tomography) equipment. Prepared by the HPA Working Party on Dental Cone Beam CT Equipment. Publication date: November 2010. ISBN: 978-0-85951-681-5.
9. HAVAS, T.E.; MOTBEY, J.A.; GULLANE, P.J. Prevalence of incidental abnormalities on computed tomographic scans of the paranasal sinuses. *Arch Otolaryngol Head Neck Surg*, v. 114, n. 8, p. 856-59, 1988.
10. KWAK, H.H.; PARK, H.D.; YOON, H.R. Topographic anatomy of the inferior wall of the maxillary sinus in Koreans. In *J Oral Maxillofac Surg*, v.33, n.4, p.382-88, 2004.
11. KILIC C.; KAMBUROGLU K.; YUKSEL S.PL; OZEN T. An assessment of the relationship between the maxillary sinus floor and the maxillary posterior teeth root tips using dental cone-beam computerized tomography. *Eur J Dent*, v.4, n.4, p.462-67, 2010.
12. LAWSON W.; PATEL, Z.M.; LIN F.Y. The development and pathologic processes that influence maxillary sinus pneumatization. *Anat Rec*, v. 291, n. 11, p. 1154-63, 2008.
13. LESSERSON, J.A.; KIESERMAN, S.P.; FIN, D.G. The radiographic incidence of chronic sinus disease in the pediatric population. *Laryngoscope*, v.104, n. 2, p. 159-66, 1994.
14. LIM, W.-K.; RAM, B.; FASULAKIS, S. et al. Incidental magnetic resonance image sinus abnormalities in asymptomatic Australian children. *J Laryngol Otol*, v. 117, n. 12, p. 969-72, 2003.

15. MACLEOD, I.; HEATH, N. Cone-beam computed tomography (CBCT) in dental practice. *Dent Update*, v.35, n. 9, p.590-98, 2008.
16. MADANI, G.; BEALE, T. J. Sinonasal inflammatory disease. *Semin Ultrasound CT MRI*, v. 30, n. 1, p. 17-24, 2009.
17. MALONEY, P.L.; DOKU, H.C. Maxillary sinusitis of odontogenic origin. *J Can Dent Assoc*, v.34, n. 11, p.591-603, 1968.
18. MEHRA, P.; MURAD, H. Maxillary sinus disease of odontogenic origin. *Otolaryngol Clin N Am*, v. 37, n. 2, p. 347-64, 2004.
19. MEHRA, P.; JEONG, D. Maxillary sinusitis of odontogenic origin. *Curr Allergy Asthma Rep*, v.9, n.3, p.238-43, 2009
20. NISHIMURA, T.; IIZUKA, T. Evaluation of the pathophysiology of odontogenic maxillary sinusitis using bone scintigraphy. *Int J Oral Maxillofac Surg*, v. 31, n. 4, p. 389-96, 2002.
21. OBERLI, K.; BORNSTEIN M.M.; VON ARX, T. Periapical surgery and the maxillary sinus: radiographic parameters for clinical outcome. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*, v.103, n. 6, p. 848-53.,2007.
22. PAZERA, P.; BORNESTEIN, MM.; PAZERA, A.; SENDI, P.; KATSAROS, C. Incidental maxillary sinus findings in orthodontic patients: a radiographic analysis using cone-beam computed tomography (CBCT). *Orthod Craniofac Res*, v.14, n.1, p.17-24, 2011.
23. ROYAL COLLEGE OF RADIOLOGISTS WORKING PARTY, Making the Best Use of a Department of Clinical Radiology: Guidelines for Doctors, 3rd edn., p. 1-96. The Royal College of Radiologists, London, 1995.

24. SCARFE, W.C.; FRAMAN, A.G.; SUKOVIC P. Clinical applications of cone-beam computed tomography in dental practice. *J Can Dent Assoc*, v. 72, n. 1, p. 75-9, 2006.
25. SCARFE, W.C.; FARMAN, A.G. What is cone-beam CT and how does it work? *Dent Clin N Am*, v. 52, n. 4, p. 707-30, 2008.
26. VAN DIS, M.L.; MILES, D.A. Disorders of the maxillary sinus. *Dent Clin N Am*, v. 38, n. 1, p. 155-66, 1994.
27. VALLO, J.; TAIPALE, L.S.; HUUMONEN, S.; SOIKKONEN, K.; NORBLAD, A. Prevalence of mucosal abnormalities of the maxillary sinus and their relationship to dental disease in panoramic radiography: results from the Health 2000 Health Examination Survey. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*, v.109, n.3, p.e80-e87,2010.
28. WHITE, S.C. Cone-beam imaging in dentistry. *Health Phys*, v. 95, n. 5, p. 628-37, 2008.
29. WHITE, S.C.; PHAROAH, M.J. The evolution and application of dental maxillofacial imaging modalities. *Dent Clin N Am*, v. 52, n. 4, p. 689-705, 2008.
30. WORTH, H.M.; STONEMAN, D.W. Radiographic interpretation of antral mucosal changes due to localized dental infection. *J Can Dent Assoc*, v. 38, n. 3, p. 111-6, 1972.
31. YOSHIURA, K.; BAN, S.; HIJIYA T. et al. Analysis of maxillary sinusitis using computed tomography. *Dentomaxillofac Radiol*, v. 22, n. 2, p. 86-92, 1993.

7. Anexos e Apêndices

Apêndice 1: Formulário de coleta de dados.

Anexo 1: Aprovação do Comitê de Ética da Universidade Federal de Goiás.

Anexo 2: Localização das paredes utilizando o software ImageJ

Anexo 3: Classificação da distância da lesão periapical ao soalho do seio maxilar. Fonte: Oberli et al (2007).

Anexo 4: Normas de publicação do periódico Dentomaxillofacial Radiology.

Apêndice 1

FORMULÁRIO PARA COLETA DE DADOS

Número do exame:

Gênero:

Lado direito

Alteração congênita
 Hipoplasia () Sim () Não
 Aplasia () Sim () Não
 Neoplasia
 () benigna () maligna

Lado esquerdo

Alteração congênita
 Hipoplasia () Sim () Não
 Aplasia () Sim () Não
 Neoplasia
 () benigna () maligna

Lesão de origem odontogênica
 () cisto inflamatório
 () cisto odontogênico
 () tumores odontogênicos benignos

Lesão de origem odontogênica
 () cisto inflamatório
 () cisto odontogênico
 () tumores odontogênicos benignos

Lesão relacionada ao osso
 () lesões ossificantes
 () displasia fibrosa
 () doença de Paget

Lesão relacionada ao osso
 () lesões ossificantes
 () displasia fibrosa
 () doença de Paget

Traumática
 () fratura

Traumática
 () fratura

iatrogênica
 () pós cirurgia Caldwell-Luc
 () comunicação buco-sinusal

iatrogênica
 () pós cirurgia Caldwell-Luc
 () comunicação buco-sinusal

() Sistêmica

() Sistêmica

Inflamatória / infecciosos
 () espessamento mucoso
 () cisto de retenção
 () opacificação
 () pólipos sinusal

Inflamatória / infecciosos
 () espessamento mucoso
 () cisto de retenção
 () opacificação
 () pólipos sinusal

() Síndrome do seio silenciosos

() Síndrome do seio silenciosos

Distância da lesão periapical ao soalho do seio maxilar
 () Classe I
 () Classe II
 () Classe III

Distância da lesão periapical ao soalho do seio maxilar
 () Classe I
 () Classe II
 () Classe III

Localização

Horizontal: A() P()
 Medial () Lateral ()
 Vertical: S() I()
 Horizontal/vertical:
 APS () API()
 AS () AI()
 PS () PI()

Localização

Horizontal: A() P() AP()
 Medial () Lateral ()
 Vertical: S() I()
 Horizontal/vertical:
 APS () API()
 AS () AI()
 PS () PI()



Classe I



Classe II



Classe III

Anexo 1



SERVIÇO PÚBLICO FEDERAL
UNIVERSIDADE FEDERAL DE GOIÁS
PRÓ-REITORIA DE PESQUISA E PÓS-GRADUAÇÃO
COMITÊ DE ÉTICA EM PESQUISA



PROCOLO
160/2010

Goiânia, 01 de julho de 2010

PARECER CONSUBSTANCIADO

I. IDENTIFICAÇÃO:

Título do projeto: "Achados incidentais de alterações da normalidade dos seios maxilares observadas em exames de tomografia computadorizada por feixe cônico (TCFC)"

Pesquisador Responsável: Inara Carneiro Costa Rege

Pesquisador Participante: Thiago Oliveira Sousa

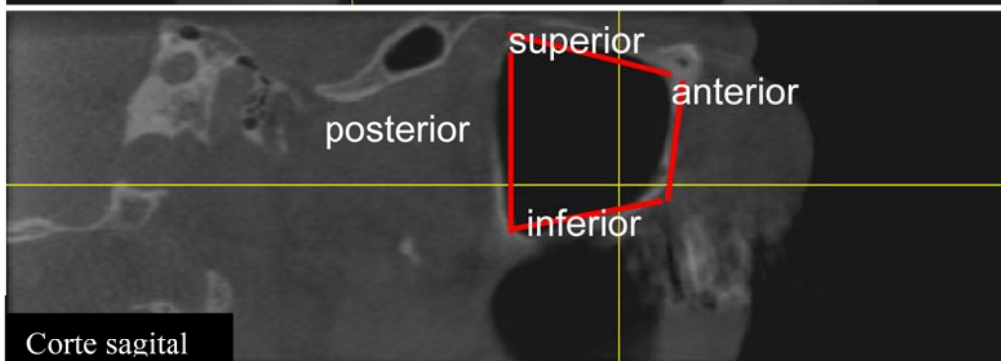
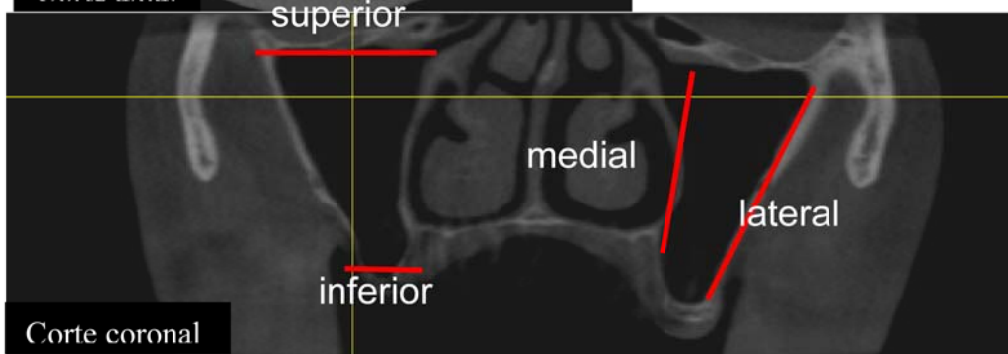
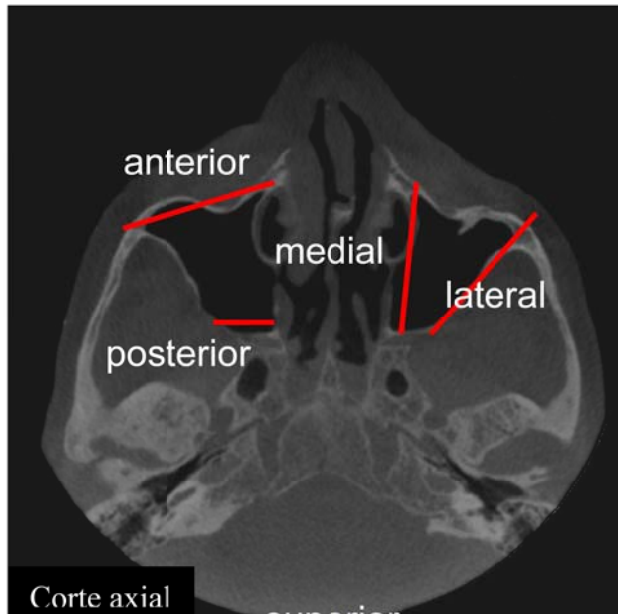
Local de realização: FO/UFG

Informamos que o Comitê de Ética em Pesquisa da Universidade Federal de Goiás, após análise das adequações solicitadas, **Aprovou**, o projeto acima referido, e o mesmo foi considerado em acordo com os princípios éticos vigentes.

O pesquisador responsável deverá encaminhar ao CEP/UFG, relatórios da pesquisa, encerramento, conclusão (ões) e publicação (ões) de acordo com as recomendações da Resolução 196/96.

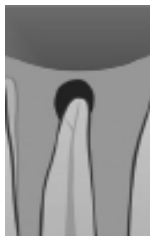
Prof. João Carlos da Rocha Medrado
Coordenador do CEP/UFG

Anexo 2

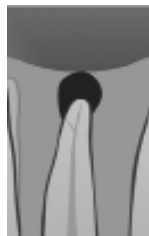


Anexo 3

Classificação da distância da lesão periapical ao soalho do seio maxilar
(OBERLI et al.2007)



Classe I



Classe II



Classe III

Anexo 4

Dentomaxillofacial Radiology

Manuscript Submissions:

<http://www.editorialmanager.com/dmfr>

Journal Homepage:

<http://dmfr.birjournals.org>

Instructions To Authors

Dentomaxillofacial Radiology (DMFR) is the journal of the International Association of Dentomaxillofacial Radiology (<http://www.iadmfr.org>). **DMFR** publishes original research papers, review articles, systematic reviews, case reports, short communications and technical reports, covering both the clinical and experimental aspects of oral and maxillofacial imaging.

Editorial policy

The Editor reserves the right to make changes that may clarify or condense papers where this is considered desirable.

Submission

Please submit manuscripts online at <http://www.editorialmanager.com/dmfr/>.

Online submission will expedite the peer review process. You will also be able to check the status of your submission online. Each paper is allocated a

reference number, which should be quoted in any communication with DMFR in connection with that paper.

Authors will be asked to transfer copyright to the publisher, The British Institute of Radiology. It is the corresponding author's responsibility to obtain the signatures of all authors and ensure that all authors approve the final version of the article.

Corresponding authors may sign the copyright agreement on behalf of all authors, but must receive their prior written permission. It is also the author's responsibility to obtain permission to include any previously published material.

Submission of a paper is intended to imply that it presents original unpublished work, either in all or in part, including the illustrations, that it is not under consideration for publication elsewhere; and that the final version has been read and approved by all the authors. All correspondence requiring signatures must be sent by regular mail, not electronically, and should include the telephone, fax number and e-mail address of the corresponding author.

Teeth should be designated in the text using the full English terminology. In tables and figures individual teeth can be identified using the FDI two-digit system, i.e. tooth 13 is the first permanent canine in the right maxilla region.

Peer-review process

All submitted manuscripts will undergo peer-review. Each manuscript is normally allocated to two reviewers. Reviewers receive manuscripts with blind title pages to ensure an unbiased review.

Reviewers are asked to provide detailed constructive criticism for transmission to the authors. DMFR requests that reviewers return their reports within 3 weeks of agreeing to review a paper. All efforts are taken to provide fair and thorough reviews as speedily as possible.

Having appraised the reviewers' reports, the Editor will make a final decision on each manuscript.

Categories of decision

- Accept
- Probable acceptance following minor revision
- Possible acceptance following major revision
- Reject

When revisions are requested, all points raised by the reviewers must be answered by the authors on a separate sheet. This itemized list of revisions must be uploaded separately with the revised manuscript. However, if the authors disagree with specific reviewers' recommendations, authors are free to explain their reasoning when resubmitting their paper.

Authors should also be aware that manuscripts may be returned without external review when the Editor deems that the paper is of insufficient general interest for the broad readership of the DMFR, or that the scientific quality is such that it is unlikely to receive favourable reviews. Editorial rejection is done to speed up the editorial process and to allow the authors' papers to be promptly submitted and reviewed elsewhere.

Preparation of manuscripts

Authors are urged to write as concisely as possible. Papers should be submitted in double line spacing with a margin of at least 3 cm all round. Papers should conform to the Uniform Requirements for Manuscripts Submitted to Biomedical Journals (Fifth Edition JAMA 1997; 277: 927–934). To expedite publication and accuracy, authors are required to submit their manuscripts in an electronic form as a formatted text document, e.g. Microsoft Word or RTF (rich text format). Any illustrations (including radiographs) should also be submitted in an electronic form. Paper manuscripts will not be accepted.

Format

1. Title pages

You will need to prepare two (2) title pages. One will be a 'blind' title page which will bear the title of the paper only. This title page will be used to ensure anonymity in the peer review process.

The second or 'full' title page should bear the title of the paper, the full names of the authors and their affiliations, together with the name, full postal address, telephone and fax number and e-mail address of the author to whom correspondence and reprint requests are to be sent. There should be a running title of not more than 25 letters and spaces.

2. Abstract

This should not exceed 250 words and should be constructed under the following subheadings: Objectives; Methods; Results; Conclusions. These subheadings should appear in the text of the abstract. Beneath the abstract

please select up to 4 keywords from the current Medical Subject Headings (MeSH) found at <http://www.nlm.nih.gov/mesh/MBrowser.html>.

3. Introduction

This should assume that the reader is knowledgeable in the field and should therefore be as brief as possible. Generally three paragraphs only are needed. The first paragraph provides an overview of the subject area with approximately 10 references maximum. (Unless the paper is a review of a topic, authors should avoid an unnecessary review of the literature, as the paper will be returned for reduction of the text.) The second paragraph should describe what is not known about the area of interest or a specific problem of clinical/scientific interest. The third paragraph briefly states the aims of the paper. Please do not use footnotes in any section of the text portion of the manuscript.

4. Materials and methods

Methods that have been published in detail elsewhere should not be described in detail. SI units should be used throughout the text (Grays, Sieverts not RADs and REMs). Any equipment or software mentioned should specify the product/model number, the manufacturer and their location (city, state and country). An appendix may be used for mathematical formulae or method details of interest to readers with specialist knowledge of the area.

5. Informed consent

Manuscripts reporting the results of experimental studies on human subjects must include a statement in the Materials and Methods that informed consent and ethical approval has been obtained.

6. Results

These should be presented succinctly in the same order as the experiments are described in the Materials and Methods. Tables and especially graphics are encouraged for quantitative information. Do not discuss the results in this section.

7. Discussion

This should comment critically on the findings from the results obtained, their relationship to existing knowledge and their significance for improved understanding of oral and maxillofacial radiology. Speculation and new hypotheses are encouraged, provided they are firmly rooted in the data presented. The last paragraph of the discussion should begin "In conclusion," and then the conclusions should be drawn. There is no separate conclusions heading or section.

8. Acknowledgments

These should be brief and should indicate any potential conflicts of interest and sources of financial support.

9. References

Authors are responsible for the accuracy of the references cited. Only papers closely related to the authors' work should be quoted. Exhaustive lists should be avoided. References should follow the Vancouver format. In the text they should appear in numerical order as superscript numbers starting at 1. The superscript numbers are placed AFTER the full point. At the end of the paper they should be listed (double-spaced) in numerical order corresponding to the order of citation in the text. A reference cited in a table or figure caption counts as being cited where the table or figure is first mentioned in the text. If there are 6 or fewer authors, list them all; if there are 7 or more, list the first 6 followed by et al. Abbreviations for titles of medical periodicals should conform to those used in the latest edition of Index Medicus. The first and last page numbers for each reference should be provided. Abstracts and letters must be identified as such. Papers in press may be included in the list of references. Papers submitted for publication and papers presented at meetings should NOT be included as references; nor should abstracts of papers presented at meetings not in the public domain. These should be cited as a personal communication in the text.

Examples of references

Journal article:

Gardner DG, Kessler HP, Morency R, Schaffner DL. The glandular odontogenic cyst: an apparent entity. J Oral Pathol 1988; 17: 359– 366.

Journal article, in press:

Dufoo S, Maupome G, Diez-de-Bonilla J. Caries experience in a selected patient population in Mexico City. *Community Dent Oral Epidemiol* (in press).

Complete book:

Kramer IRH, Pindborg JJ, Shear M. *Histological typing of odontogenic tumours* (2nd edn). Berlin: Springer Verlag, 1992.

Chapter in book:

DelBalso AM, Ellis GE, Hartman KS, Langlais RP. Diagnostic imaging of the salivary glands and periglandular regions. In: DelBalso AM (ed). *Maxillofacial imaging*. Philadelphia, PA: WB Saunders, 1990, pp 409–510.

Abstract:

Mileman PA, Espelid I. Radiographic treatment decisions – a comparison between Dutch and Norwegian practitioners. *J DentRes* 1986; 65: 609 (Abstr 32).

Letter to the Editor:

Gomez RS, de Oliveira JR, Castro WH. Spontaneous regression of a paradental cyst. *Dentomaxillofac Radiol* 2001; 30: 296 (letter).

Journal article on the internet:

Aboud S. Quality improvement initiative in nursing homes: the ANA acts in an advisory role. *Am J Nurs* [serial on the Internet]. 2002 Jun [cited 2002 Aug 12];102(6):[about 3 p.].

Available

from: <http://www.nursingworld.org/AJN/2002/june/Wawatch.htm>

Homepage/Web site:

Cancer-Pain.org [homepage on the Internet]. New York: Association of Cancer Online Resources, Inc.; c2000-01 [updated 2002 May 16; cited 2002 Jul 9]. Available from: [http:// www.cancer-pain.org/](http://www.cancer-pain.org/).

10. Tables

Number tables consecutively with an Arabic numeral. Each table should have a separate caption or title. Methods not described in the text and any abbreviations should be explained at the foot of the table. Tables should be referred to specifically in the text of the paper. Tables are to include NO vertical rules and are to be submitted as editable text.

11. Figures

Number figures consecutively using Arabic numerals. Each figure should have a detailed legend listed on a separate sheet of paper with the heading Figure Legends. Figures should be referred to specifically in the text. Labelling of artwork should be Arial 8 point font. Ideally, figure sizes should be 84 mm wide, 175 mm wide or the intermediate width of 130 mm.

11.1 Points to note:

Do not put a box around graphs, diagrams or other artwork. Avoid background grid lines unless these are essential (e.g. confidence limits). A coarse pattern such as hatching should be used (shading is liable to break up on the printed copy). Keys to symbols should be given underneath the figure itself and not in the legend. Lines in all graphs (including axes), diagrams and other artwork should be 1 point in weight. Label axes clearly in Arial 8 point font and include

all units of measurement. Centre the label along the axis and align the direction of the text with the axis.

Do not use three-dimensional histograms when the addition of a third dimension gives no further information. Submit radiographic images trimmed so as to show no more than is necessary to illustrate the points made by the author, at the same time retaining sufficient anatomical landmarks. Where radiographs, particularly panoramic radiographs, are difficult to reproduce adequately, the author should consider digital enhancement (for an example see *Dentomaxillofac Radiol* 1999; 28: 348–350). The legend should state that the radiograph has been digitally enhanced. Patient identification must be obscured and side marks and transfer arrows applied to point out a particular feature where necessary. Patient consent must be obtained in writing if photographs are to be reproduced.

11.2 Image files

Image files should be supplied in EPS, TIFF or JPEG format.

TIFF is preferred for halftones, i.e. medical images such as radiographs, MR scans etc. EPS is preferred for drawn artwork (e.g. line drawings and graphs) For JPEG files, it is essential to save at maximum quality, i.e. “10”, to ensure that quality is satisfactory when the files are eventually decompressed.

DO NOT supply PowerPoint files as these may be problematic with respect to quality rendering. DO NOT supply GIF files—GIF is a compressed format that can cause quality problems when printed. Save each figure should be uploaded separately and numbered, e.g. “Figure 1”, “Figure 2” etc.

11.3 Colour

Unless essential to the content of the article, all illustrations should be supplied in black and white, with no colour (RGB, CMYK or Pantone references) contained within them. Images that do need to be reproduced in colour should be saved in CMYK, with no RGB or Pantone references contained within them.

The cost of reproduction of colour images will be charged to the author at the following rates: £300 for one colour image, £500 for two colour images and £100 for each subsequent additional colour image.

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Files should be saved at the appropriate dpi (dots per inch) for the type of graphic (the typical screen value of 72 dpi will not yield satisfactory printed results): Line drawings - save at 800 dpi (or 1200 dpi for fine line work)

Halftone and colour work - save at 300 dpi.

11.5 Composition

The image should be cropped to show just the relevant area, and the amount of white space around the illustration should be kept to a minimum. All annotations (e.g. arrows) should be included within the images supplied.

11.6 Additional points

Fonts should be Adobe Type 1 standard - Helvetica or Times are preferred.

Ensure that lettering is appropriately sized – should correspond to 8 or 9 pt when printed.

All lines (e.g. graph axes) should have a minimum width of $\frac{1}{4}$ pt (0.1 mm) otherwise they will not print; 1 pt weight is preferable. Avoid using tints, but any

that are used must be at a minimum 5% level for that tint to print (but do not use too high a tint as it may print too dark). Captions should be incorporated in the manuscript text rather than in the image file.

Case Reports

The format for Case Reports is Abstract, Case Report and Discussion.

Short Communication

A research paper reporting preliminary findings from a hypothesis-driven piece of research. It should contain the same structure as a full research paper with Introduction, Methods, Results and Conclusion.

Technical Report

A Technical Report is not a hypothesis-driven research report but describes a radiographic technique or piece of software of interest to a clinician or researcher in a relevant field of interest.

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