A comparative study for image quality and radiation dose of a cone beam CT (CBCT) and a multi slice CT (MSCT) for paranasal sinus imaging

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Introduction

• CBCT: relatively new
• Introduced into dentistry about twenty years ago
• Widely used for dentomaxillofacial imaging
• Advantages: Isotropic spatial resolution, relatively low dose requirements, low cost, easy accessibility
Introduction

• Shortcomings: inconsistency in properties and settings, lack of evidence-based data on radiation dose and image quality
• Multitude of settings, wide diversity of image quality, results and radiation dose
• Lack of standardization, many different devices
Purpose

• CBCT and MSCT both widely for paranasal sinus pathology
• Evaluation image quality, radiation dose
• State of the art
• Patients with nasal polyposis
Materials and Methods

• Retrospective study
• 57 patients with new diagnosis of nasal polyposis on CBCT or MSCT
• Control group of 90 patients with normal radiological findings
• Between January 2010 and December 2012
• Two radiologists
Materials and Methods

• Image quality (five point scale): lamina papyracea, lamina cribrosa, uncinate process, middle turbinate, frontal recess and sphenoidethmoid recess
Materials and Methods

• RANDO head phantom with thermoluminescent dosimeters
Results

• Effective dose for MSCT was 41% higher compared to CBCT (108 μSv vs 63 μSv)
## Organ and effective doses

<table>
<thead>
<tr>
<th>Organ</th>
<th>Dose (µSv)</th>
<th>Siemens Definition Flash</th>
<th>Dose Increase (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red bone marrow</td>
<td>119.2</td>
<td>166.5</td>
<td>39.7</td>
</tr>
<tr>
<td>Thyroid</td>
<td>65.4</td>
<td>304.0</td>
<td>364.8</td>
</tr>
<tr>
<td>Skin</td>
<td>57.9</td>
<td>62.9</td>
<td>8.6</td>
</tr>
<tr>
<td>Bone surface</td>
<td>593.9</td>
<td>706.3</td>
<td>18.9</td>
</tr>
<tr>
<td>Salivary Glands</td>
<td>1018.0</td>
<td>1698.1</td>
<td>66.8</td>
</tr>
<tr>
<td>Brain</td>
<td>1066.3</td>
<td>1444.6</td>
<td>35.5</td>
</tr>
<tr>
<td>Oesophagus</td>
<td>26.6</td>
<td>196.1</td>
<td>637.2</td>
</tr>
<tr>
<td>Remainder</td>
<td>148.0</td>
<td>241.9</td>
<td>63.4</td>
</tr>
<tr>
<td>Effective Dose</td>
<td>63.1</td>
<td>108.1</td>
<td>41.6%</td>
</tr>
</tbody>
</table>
Discussion

• Acceptable for clinical use by both readers for both imaging modalities
• Differences reflect unique features
• CBCT ideal for bony structures with good aeration
• Images get degraded with inflammatory wall thickening because the low radiation emitted
Discussion

- CBCT susceptible to movement artifacts
- Also, low contrast range, higher noise, and limited field of view
- Inability to quantitatively measure tissue density like Hounsfield units
- MSCT radiation doses decreased the last years
Conclusions

Limitations:
- subjectivity due to background
- between-subjects design vs. within-subjects design
- the five point scale is somewhat subjective
Conclusions

• CBCT and MSCT are both suited for sinonasal pathology
• In patients with nasal polyposis MSCT slightly better
• In normal studies CBCT slightly better
• Radiation exposure is 42% higher in MSCT
A comparative study for image quality and radiation dose of a cone beam computed tomography scanner and a multislice computed tomography scanner for paranasal sinus imaging

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Thank you for your attention!