Management of the Mandible in cancer of the Oral Cavity

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Cancer of the mandible refers to mucosal squamous cell carcinoma of the alveolar process of the mandible that invades the underlying mandibular bone. According to several statistics, it represents the second in frequency site after carcinoma of the tongue. It has the highest local recurrence rate.

<table>
<thead>
<tr>
<th>Table 2: Table showing the distribution of tumours by site together with the mean age at presentation for each site.</th>
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</thead>
<tbody>
<tr>
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<tr>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Tongue (all sites)</td>
</tr>
<tr>
<td>Mandibular Alveolus</td>
</tr>
<tr>
<td>Floor of Mouth</td>
</tr>
<tr>
<td>Cheek/Commissure</td>
</tr>
<tr>
<td>Antrum</td>
</tr>
<tr>
<td>Lip (mucosa)</td>
</tr>
<tr>
<td>Retromolar and Fauces</td>
</tr>
<tr>
<td>Palate (hard and soft)</td>
</tr>
<tr>
<td>Maxillary Alveolus</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Table 10: Table showing local recurrence rate by site.</th>
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36 Patients (44.3%) developed a local recurrence of their carcinoma. Raw Chi Square = 17.18. P = 0.07.
**Classification**

**T1**
No Bone Invasion

**T2**
Invasion within Alveolar Bone

**T3**
Invasion beyond alveolar bone but above the LMC

**T4**
Invasion including the LMC

**LMC: Level of Mandibular Canal**

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**ORAL SQUAMOUS CELL CARCINOMA OF THE MANDIBULAR REGION: A SURVIVAL STUDY**

Juan Carlos De Vicente, MD, DDS, PhD, Oliver Rodríguez Recio, MD, DDS, Santiago Liorente Pendas, MD, DDS, PhD, Juan Sebastián López-Arranz, MD, DDS, PhD

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**Figure 1.** Kaplan-Meier estimate of overall survival (n = 49 patients with SCC of the mandibular region).

**Figure 2.** Kaplan-Meier estimate of survival by tumor site.
Histological Patterns of Tumor Invasion

- **Invasive pattern** – (infiltrative pattern)
  - Islands of tumor infiltrate cancellous spaces
  - Little osteoclastic activity
  - No intervening connective tissue

- **Erosive pattern** – (compressive patterns)
  - Tumor advances as a broad front
  - Active osteoclasts separating tumor from bone
  - Connective tissue layer separating tumor/bone

Patterns of invasion in the invasive front

Erosive

Solid border / solid cords

Invasive

Infiltrating small groups and single cells
Patterns of Mandibular Invasion
Routes of Entry into Mandible

• Direct penetration through occlusal surface
• Through periodontal membrane (interdental)
• From the attached gingiva

Table 5. Routes of tumor entry into the mandible.

<table>
<thead>
<tr>
<th>Routes of tumor entry</th>
<th>No. of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct</td>
<td>28</td>
</tr>
<tr>
<td>Direct through the junction of attached and reflected mucosa in the dentate patient (gingival)</td>
<td>4</td>
</tr>
<tr>
<td>Occlusal surface</td>
<td>23</td>
</tr>
<tr>
<td>Unsure (extensive crestal invasion)</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
</tr>
</tbody>
</table>
Patterns of Mandibular Invasion
Routes of Entry into Mandible

• Through mental or mandibular foramena
• From metastatic neck tumor through lower border of mandible
• Cortical bone defects in edentulous alveolar ridge

PATTERNS OF INVASION AND ROUTES OF TUMOR ENTRY INTO THE MANDIBLE BY ORAL SQUAMOUS CELL CARCINOMA

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Published online 6 March 2002 in Wiley InterScience (www.interscience.wiley.com).

FIGURE 1. Deeply invading soft tissue tumor directly abutting the mandible can invade at the crest and the lower border.
Patterns of Mandibular Invasion by Gingival Squamous Cell Carcinoma

Takehito Nomura, DDS, PhD,* Takahiko Sibata, DDS, PhD,† Nian-Hui Cai, DDS, PhD;‡ and Hiroyasu Noma, DDS, PhD§

Purpose: This study examined patterns of invasion of lower gingival cancer into the mandible. Our goal was to clarify the most common routes for gingival squamous cell carcinoma to enter and spread within the mandible.

Patients and Methods: The subjects were 176 patients with lower gingival squamous cell carcinoma who underwent mandibulectomy; all tumors were examined histopathologically. The method of mandibulectomy was decided on the basis of conventional plain radiographic and computed tomographic findings.

Results: The tumor extended to the periostea in 33%, to the cortical bone in 23%, and to the bone marrow in 9% of the patients who underwent mandibular resection. The remaining 35% of our patients had no evidence of mandibular invasion.

Conclusion: The area of bone resorption on preoperative clinical and radiographic examinations often disagreed with the extent of mandibular invasion on histopathologic examination.

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Mandibular Invasion in Carcinoma of the Lower Alveolus

Kam H. Lam, FHKAM, Lai K. Lam, FHKAM, Chiu M. Ho, FHKAM, William I. Wei, FHKAM

Purpose: Efforts to conserve the mandible in resection for oral cancer tend to bring the resection margin progressively closer to the tumor front. This study of the manner of mandibular invasion by carcinoma of the lower alveolus provides added information regarding the behavior of the cancer within the bone.

Materials and Methods: Twenty-four resected specimens of squamous carcinoma of the lower alveolus were studied with x-rays and step-serial whole-organ histological sections.

Results: In 19 of the 21 specimens showing bone invasion, the spread was in the form of a broad front. Invasion of tumor beyond the tumor front was extensive in 9 of 13 tumors showing deep mandibular invasion. Horizontal sub cortical spread took place in 5 of 18 specimens for a distance of up to 1 cm. Perineural spread along the inferior alveolar nerve was found in 4 of 13 specimens in which the tumor extended to the canal; tumor spread along the canal, without neural involvement, was never seen. Preoperative orthopantomogram correctly estimated the extent of mandibular invasion in 16 of 24 patients.

Conclusions: The tumor front of mandibular invasion by carcinoma of the lower alveolus is usually broad. In the absence of deep invasion, which is defined by invasion reaching the alveolar canal, there is little or no invasion of cancer cells beyond the tumor front, and no spread along the alveolar canal. Marginal mandibulectomy can be applied more widely, taking a margin of 1 cm in all directions.

How to detect mandibular invasion

- Clinical examination
- Radiographs (plain OPG)
- CT – DentaScan
- MRI
- Bone scans
- Ultrasound
- PET CT
- Ultimate proof: histology

A comparison of different imaging modalities and direct inspection after periosteal stripping in predicting the invasion of the mandible by oral squamous cell carcinoma

J. S. Brown, J. F. Griffith, P. D. Phelps, R. M. Browne

1. To assess further the use of conventional investigations (OPG and bone scintigraphy).
2. To compare conventional investigations with CT and MRI in the same patients.
3. To assess the accuracy of direct examination of the bone by lifting the periosteum in close proximity to the tumour.
4. To provide guidance on the most useful setting for the MRI scanner in the assessment of mandibular invasion.
5. To develop a protocol for the investigation of tumours of different size and site in relation to mandibular invasion.
Accuracy in the diagnosis of mandibular involvement by oral cancer

A. Zupi¹, L. Califano², P. Maremonti³, F. Longo¹, R. Ciccarelli², A. Soricelli²

¹Department of Maxillofacial Surgery, ²Department of Radiology, ³Department of Nuclear Medicine and National Cancer Research, 'Federico II' University of Naples, Naples, Italy

SUMMARY: Cancer of the mandibular region usually has a poor prognosis; this is particularly correlated to invasion of the mandible. To reduce the consequences of poor therapeutic planning, careful preoperative assessment of bone infiltration is necessary.

We have examined the records of 50 patients evaluated by clinical examination, conventional radiography, computed tomography (CT), bone scintigraphy with ⁹⁹mTc and magnetic resonance imaging (MRI).

The highest sensitivity (100%) was attained by scintigraphy; the highest values of specificity (96.3%) were reached by CT scan and MRI. A CT scan showed the highest predictive positive value (95.4%) and efficiency (94%), this plus MRI have good values and the associated sensitivity and efficiency are higher than when these techniques are used alone.
Correlation of imaging and clinical features in the assessment of mandibular invasion of oral carcinomas


Bone SPECT reduces the number of unnecessary mandibular resections in patients with squamous cell carcinoma

Ellen M. Van Cann, Wim J.G. Oyen, Ron Koole, Paul J.W. Stoltinga

Summary High percentages (35–78%) of resected mandibles without bone invasion have been reported in squamous cell carcinoma (SCC), adjacent or fixed to the mandible, stressing the need for accurate imaging methods. The aim of this study is to determine the value of bone single photon emission computed tomography (SPECT) for the evaluation of mandibular invasion by SCC. Seventy-nine patients with SCC, adjacent or fixed to the mandible, were included. The results of bone SPECT were compared to the histology of the resection specimens. Bone SPECT was positive in all 50 patients with mandibular invasion and negative in 17 of 29 patients without mandibular invasion. In conclusion, a negative bone SPECT rules out mandibular invasion. Important clinical implications are then that further imaging is not necessary and that the resection can be kept limited. Inclusion of SPECT in the preoperative assessment of these patients will lead to a considerable reduction of unnecessary mandibular resections.

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Table 3  Results of bone SPECT and results of histological examination of the resection specimens

<table>
<thead>
<tr>
<th>Group</th>
<th>Histology</th>
<th>Group C</th>
<th>Group O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>43</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>Negative</td>
<td>0</td>
<td>0</td>
<td>17</td>
</tr>
</tbody>
</table>

Group CM: Invasion through the cortex into the medullary bone, Group C: only cortical invasion and Group O: no mandibular invasion.
Positive predictive value 83.7% and negative predictive value 100%.

Table 4  Results of bone SPECT in patients with no teeth in the vicinity of the tumour and results of histological examination of the resection specimens

<table>
<thead>
<tr>
<th>Group</th>
<th>Histology</th>
<th>Group C</th>
<th>Group O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>25</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Negative</td>
<td>0</td>
<td>0</td>
<td>12</td>
</tr>
</tbody>
</table>

Group CM: Invasion through the cortex into the medullary bone, Group C: only cortical invasion and Group O: no mandibular invasion.
Positive predictive value 88.2% and negative predictive value 100%.

In conclusion, inclusion of SPECT bone scans in the preoperative assessment of patients with SCC, adjacent or fixed to the mandible will lead to a considerable reduction in the number of unnecessary mandibular resections in general. This will reduce the morbidity and will considerably improve HRQOL in these patients.

Comment on 'Bone SPECT reduces the number of unnecessary mandibular resections in patients with squamous cell carcinoma' [Van Can EM, Oyen WJG, Koole R, Stoelinga PJW. Oral Oncology 2006;42:409–14]

I was struck by the boldness of this title and drawn to this paper with interest. I was disappointed, however, in that the data if anything was more likely to result in an increased number of segmental resections. The authors compare the results of SPECT scan to a segmental resection. By introducing the SPECT scan (sensitivity 100%, specificity 95%, 12 false positives) it is far more likely that clinicians would be inclined to be more radical in their approach, if the scan was positive, and confi...
DentaScan as an Accurate Method of Predicting Mandibular Invasion in Patients With Squamous Cell Carcinoma of the Oral Cavity

John M. Brockenbrough, MD, Gay J. Petruzzelli, MD, PhD, Laurie Lomasney, MD

Results: The diagnostic accuracy for DentaScan in this study was as follows: sensitivity, 95%; specificity, 79%; positive predictive value, 87%; and negative predictive value, 92%.

Figure 4. Algorithm for management of patients with squamous cell carcinoma of the oral cavity suspicious for mandibular invasion.
Marginal resection

Anterior
Marginal Mandibulectomy
Marginal resection
LOCAL CONTROL OF SQUAMOUS CELL CARCINOMA FOLLOWING MARGINAL AND SEGMENTAL MANDIBULECTOMY

Sanford Dubner, MD, and Keith S. Heller, MD

Table 3. Local recurrence rate (tumor size).

<table>
<thead>
<tr>
<th>Tumor size</th>
<th>Type of mandibulectomy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Marginal</td>
</tr>
<tr>
<td>T1</td>
<td>5/24 (21%)</td>
</tr>
<tr>
<td>T2</td>
<td>7/37 (19%)</td>
</tr>
<tr>
<td>T3</td>
<td>2/8 (22%)</td>
</tr>
<tr>
<td>T4</td>
<td>1/9 (11%)</td>
</tr>
<tr>
<td>Total</td>
<td>15/79 (19%)</td>
</tr>
</tbody>
</table>

Table 5. Local recurrence rate and mandibular invasion.

<table>
<thead>
<tr>
<th>Mandible</th>
<th>Type of mandibulectomy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Marginal</td>
</tr>
<tr>
<td>Tumor invasion</td>
<td>8/9 (89%)</td>
</tr>
<tr>
<td>No tumor invasion</td>
<td>13/70 (19%)</td>
</tr>
</tbody>
</table>
Take home message

Suspected mandibular invasion from oral squamous cell carcinoma

• Clinical examination
• OPG
• Denta Scan
• Bone Scan (Tc 99 – SPECT)

When negative:
Marginal mandibulectomy
Suspected mandibular invasion from oral squamous cell carcinoma

• Clinical examination
• OPG
• Denta Scan
• Bone Scan (Tc 99 – SPECT)

When positive:
Segmental mandibular resection and reconstruction

When equivocal:
Intraoperative periosteal stripping
Take home message

Suspected mandibular invasion from oral squamous cell carcinoma

• Clinical examination
• OPG
• Denta Scan
• Bone Scan (Tc 99 – SPECT)

When equivocal:
Intraoperative periosteal stripping

When positive:
Segmental mandibular resection and reconstruction

When negative:
Marginal mandibulectomy
Second World Congress of the International Academy of Oral Oncology (IAOO)

July 8 – 11, 2009

Sheraton Centre, Toronto

Invitation to Toronto!