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Buccal Mucosa Cancer
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1 Introduction

In Europe and North America, buccal mucosa carcinoma represents 3 to 5% of oral-cavity cancer; it is much more frequent in South Asia and Latin America. These differences are due to people chewing arec and betel nuts, tobacco leaves and coca leaves mixed with lime, since these are carcinogenic. In developed countries, tobacco contributes in one third of patients and alcohol in 20% of them, but these aetiological factors are often underestimated. The proportion of females is higher than in other head-and-neck cancers: the sex ratio is 3 : 1 (males/females).

Clinical symptoms are in decreasing order: simple discomfort, mass, pain, trismus, neck node. (3)

Primary tumours less than 40 mm in size, involving the anterior two thirds of the buccal mucosa, without involvement of the gingiva and intermaxillary commissura, constitute an "ideal" indication for brachytherapy.

External beam radiation alone or combined with brachytherapy is reserved for tumours larger than 40 mm or where radical surgery is contraindicated. (2)

Wide local excision with a safety margin of at least 5 mm is one of the treatments of choice for well-circumscribed limited tumours. Radical surgery is indicated for tumours invading the intermaxillary commissure or gingiva; this therapeutic approach is very invasive and must be followed by a reconstructive procedure. (1,13)

2 Anatomical Topography

The buccal mucosa is bounded by the lower and upper gum sulcus; the lip commissure constitutes its anterior limit; the posterior limit is the intermaxillary commissure. (8)

Lymphatic drainage is to submandibular nodes or directly to jugular nodes. (8,12)
Critical organs are the mandible, the gingiva and the teeth, but also, in the case of very infiltrating tumours, soft tissues such as muscles and skin. (3,4)

Fig 11.1: Primary squamous-cell cancer of the buccal mucosa.
3 Pathology

Macroscopically, tumours may be exophytic, ulcerating, infiltrating or nodular or any combination. The ease of brachytherapy depends on the exact position in the cheek. Most tumours are squamous cell carcinomas. Other histopathological types are: glandular carcinomas, lymphosarcomas, melanomas. Precancerous lesions are observed in one third of patients. Nodal involvement is noted at the time of the initial diagnosis in about 40% of patients. (2,12)

4 Work Up (see chapter on Head and Neck general aspects)

The work-up is comparable to other cancers of the oral cavity, but the particular carcinogenetic and epidemiological factors must be evaluated. (12) Because of the frequent association of malignant and premalignant tumours, the tumour site must be accurately described by diagrams, biopsies, ultrasound and MRI. (1,13)

5 Indications, Contra-indications

Interstitial brachytherapy is strongly indicated for lesions of the anterior and central part of the buccal mucosa. If there is deep involvement of the gingivobuccal sulcus, brachytherapy is contraindicated as in floor of mouth carcinoma, because of the unacceptable risk of osteoradionecrosis to the mandible. (3,4,7)

For the posterior third of the buccal mucosa, the indication for implant alone must be discussed case by case. In fact, it is usually very difficult to evaluate tumour extension to the retromolar trigone accurately and even more difficult to the intermaxillary commissure. (4,5)

Interstitial brachytherapy alone is indicated for small (< 40 mm), well-defined tumours, located in the anterior two thirds of the buccal mucosa. This brachytherapy is followed, as for other oral-cavity carcinomas, by a cervical node dissection in selected cases. (4,7)

For tumours larger than 40 mm, or tumours involving the posterior third of the buccal mucosa (without involvement of the intermaxillary commissure), a combination of external-beam radiation and brachytherapy boost is indicated.

When brachytherapy is contraindicated because of involvement of mandible, maxillary or intramaxillary commissura and/or the tumour volume (>40 mm) external-beam radiotherapy is indicated or in selected cases radical surgery with reconstruction. (1,13)

6 Target Volume

The target volume is defined by intraoral examination completed by a bidigital palpation of the tumour; with one finger in the mouth and the other on the skin of the cheek. (4) The projection of the gross tumour volume (GTV) should be drawn and the clinical target volume (CTV) mapped out on the surface of the skin. The CTV comprises the GTV plus a safety margin of 10 mm at the anterior and posterior parts of the tumour (GTV) and one of 5 to 10 mm at its upper and lower limits, according to the position of the tumour in relation to the mandible and upper maxilla.
The drawing is completed by the projection of the different healthy structures, such as upper maxilla and mandible. During this procedure, the mouth is alternatively open and closed.

If brachytherapy is used as a boost, the initial tumour volume must be known: its outer limits can be marked with metallic clips, but these may move during the first phase of treatment and it is therefore safer to draw the projection on to the skin, photograph the patient, and tattoo the peripheral intrabuccal limits of the tumour differentiating as well as possible cancer and precancerous lesions. (2)

CT-scan or preferably MRI can contribute to defining the tumour volume and consequently the target volume more accurately. MRI is used at the time of diagnosis but also after the plastic tubes are implanted to check the quality of the implant and to adjust the position of the radioactive sources.

7 Technique

Two implantation techniques are mainly used: guide gutters and plastic tubes according to the tumour volume and site.

7.1 Superficial, well limited, anterior lesions, close to the lip commissure, smaller than 20 mm in size are appropriate for the guide-gutter technique. (3,4) This implant can be performed under local anaesthesia. The guide gutters are implanted parallel to the buccal mucosa in the anteroposterior direction. The patient's mouth is open and an intraoral finger of the operator checks the position of the guide gutter. In general, one double-guide gutter is sufficient, sometimes completed by an extra single-guide gutter. After the replacement of the gutters by iridium hairpins, the relative position of the suture around the bridge to the lip commissure is crucial to maintain the radioactive material in position and be tolerated well by the patient.

7.2 The plastic-tube technique is indicated for all other lesions: the number of lines, distance between the lines, number of planes and distance between the planes are established according to the dimensions of the target volume.

Fig 11.2: Plastic-tube technique: the dimensions of the tumour projected on the skin surface of the cheek are checked according to the positioning of the metallic needles.

Fig 11.3: Classical plastic tube implant: four lines equidistant and parallel maintained in position by a perforated catheter.
There are two ways of implanting a buccal mucosa carcinoma, taking into account the thickness of the tumour and the anatomical characteristics of the cheek, whose thickness increases from the lip commissure to the intermaxillary commissure.

7.2.1 With the first technique, the needles are implanted through the skin: first parallel to each other, parallel to the oral mucosa and parallel to the horizontal branch of the mandible. Under digital control, the lines are placed approximately 3-5 mm deep, under the buccal mucosa. They should cover 10 mm of normal mucosa behind or in front of the lesion with a recommended spacing of 12 to 15 mm. Two or three plastic tubes are usually required to cover the target volume if the thickness of the tumour does not exceed 5 mm. Plastic spacers at both ends keep the tubes parallel. Retention buttons are fixed at both extremities (Fig 11.2,3).

If the lesion is thicker than 5 mm, a second plane of tubes is implanted between the first one and the skin, with an interplane spacing equal to the intersource spacing in each plane.

With a single plane, the thickness of the target volume equals about 50% of the space between the lines (i.e. distance 18 mm, treated thickness 9 mm). If the thickness to be treated is greater, 2 planes are necessary or the second technique should be chosen (Fig 11.4).

When the lesion is posterior, near the intermaxillary commissure, there is a risk of geographic miss at the back with the parallel tubes, because isodose curves indent between the wires. In this case, we recommend a posterior loop whose top is as close as possible to the intermaxillary commissure. The two horizontal branches of this loop can be distanced 30 to 45 mm; one to two other lines are implanted in-between. If four plastic tubes are implanted, they can form a double loop: a small anterior one, close to the labial commissure, and a posterior one, close to intermaxillary commissure. A loop forms a posterior barrier by linking the two outside parallel wires inside the cheek at 5 mm from the bucco-alveolar sulcus in its upper and inferior parts. To perform the bridge...
of the loop, the needles are implanted vertically through the skin into the mucosa or placed intraorally under the buccal mucosa, with the help of a Reverdin needle (Pernot technique) (5,7) or a curved hollow needle (Gerbaulet technique) (3,4) (see chapters on oropharynx, bladder) (Fig 11.5).

Fig 11.5: Radiograph with dummy sources (lead wires) showing a double loop procedure: anterior loop/labial commissure, posterior loop/intermaxillary commissure.

Fig 11.6: Plastic tube technique: The plastic tubes are inserted, an anterior loop is performed close to the labial commissural.

Fig 11.7: Plastic tube technique: the top of the anterior loop is loaded to well-irradiated labial commissura, check radiograph of Iridium wires.
To improve the homogeneity of the dose, a median plastic tube is placed between the two parallel branches, to obtain a spacing of 12 to 15 mm between each line. The posterior end of the median radioactive wire must be about 7 mm from the bridge of the loop to avoid a hot spot. A customized lead gutter is highly recommended to reduce the risk of osteoradionecrosis.

When the lesion is anterior, close to the commissure, the two outside parallel plastic tubes can be replaced by a loop, using the same technique as that described above for posterior tumours (Fig 11.6,7).

7.2.2 A second technique, (Gerbaulet technique) used for very bulky infiltrating tumour is to implant the needles perpendicularly to the skin of the cheek organized in several loops to cover the target volume (Fig 11.8). (3)

7.2.3 The loading is determined based on the target volume (CTV) according to the rules of the Paris System. Whereas for other interstitial implants in head-and-neck carcinoma, radioactive sources are perpendicular to the surface of the tumour, for buccal mucosa they are (except for the second technique used in very bulky lesions) parallel to it, as it is usual for skin or lip cancers.

For all these different implants, the position of the lines must be checked not only when the mouth is open but also closed, with the shielding device in place inside the oral cavity. In general, the shielding system may reduce the thickness of the target volume by stretching the cheek and squeezing the tumour so irradiation is better adapted. (3,5)
8 Dosimetry

Dosimetry is established from two orthogonal radiographs complemented by CT scan and/or MRI, to determine as closely as possible both GTV and CTV. Different planes are chosen, perpendicular to the radioactive lines: in the frontal plane when the lines are parallel to the buccal mucosa, in the sagittal plane when the lines are perpendicular to the buccal mucosa. According to the Paris System the central plane constitutes the reference plane. The reference dose is 85% of the basal dose rate. (4)

9 Dose, Dose Rate, Fractionation

The total dose for LDR brachytherapy is 65 to 70 Gy for brachytherapy alone, 25 to 30 Gy when brachytherapy is used as a boost after 45 to 50 Gy of external-beam irradiation. (3,4,5,7)

10 Monitoring

See chapter on head-and-neck general considerations.

11 Results

The largest multicentric study was done by the GEC (Groupe Européen de Curiethérapie) (Gerbaulet and Pernot.) (2) Seven hundred forty-eight patients were treated for primary tumour with: brachytherapy alone (31%) (A), combination of external beam irradiation + brachytherapy (11%) (B), external beam irradiation alone (36%) (C), surgery often followed by radiation therapy (22%) (D). These different therapeutic approaches were adapted to prognostic factors: tumour size, tumour site, nodal status. (12) Five-year NED survival rate according to T stage was: T1 61%, T2 46%, T3 33%, T4 10%. For the various treatments, the local failure rate (including all primary tumours) was: 19% for brachytherapy alone, 35% for combination external beam irradiation + brachytherapy and for external beam irradiation alone, 22% for surgery ± external beam irradiation.

With the exception of the GEC multicentric trial, few other reports have been published of brachytherapy in buccal-mucosa carcinoma (Table 11.1).

In these different studies, patients were treated with brachytherapy alone (A) or with combined external-beam radiation and brachytherapy boost (B) in nearly 700 cases. When the two treatments are compared, survival and local-control rates are better for brachytherapy 60% versus 35% and 75% versus 60%, respectively. Very few data have been published on complication rates. They are estimated to be about 15 to 20% for brachytherapy alone (A) and 25 to 30% for combined irradiation (B) (Fig 11.9,10).
Fig 11.9: Typical aspect of an exophytic tumour of the buccal mucosa.

Fig 11.10: Result one year after treatment.

Table 11.1: Results for treatment of buccal mucosa cancer

<table>
<thead>
<tr>
<th>Authors</th>
<th>Pts</th>
<th>TNM</th>
<th>Treatments</th>
<th>Brachy</th>
<th>Survival %</th>
<th>Local Control %</th>
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<tr>
<td>Gerbaulet (2)</td>
<td>748</td>
<td>106 T1 210 T2 175 T3 257 T4</td>
<td>A 266 B 80 C 273 D 167</td>
<td>LDR Ra, Au, Ir</td>
<td>A 64 B 41 C 26 D 66</td>
<td>A 81 B 65 C 45 D 78</td>
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<td>Gerbaulet (3,4)</td>
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<td>23 T1 33 T2 23 T3 6 Tx</td>
<td>A B</td>
<td>LDR Ir</td>
<td>A 60 B 31</td>
<td>A 74 B 52</td>
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<td>42</td>
<td>T1-3 36 N0 35 Plastic tubes: parallel/loops</td>
<td>LDR Ir</td>
<td>OS 48 CSS 74 DFS 54</td>
<td>Parallel 58 Loops 91</td>
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<td>AS 81</td>
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Legends:
- **Treatments:**
  - A: brachytherapy alone
  - B: EBRT + brachytherapy
  - C: EBRT alone
  - D: Surgery ± EBRT
  - IBT: interstitial brachytherapy
  - Perm Impl: Permanent implants
- **Results:**
  - AS: Actuarial Survival
  - OS: Overall Survival
  - CSS: Cancer Specific Survival
  - DFS: Disease Free Survival


12 References