Brachytherapy

In Early Oral Cancers

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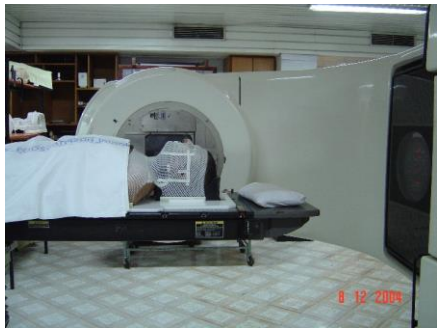
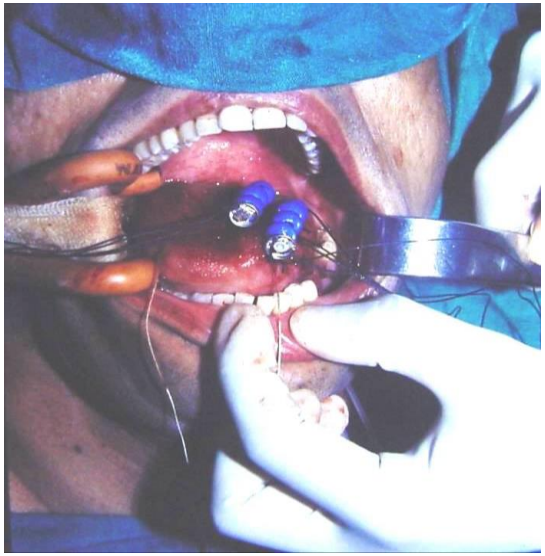
Oral cancers: Role of Radiotherapy

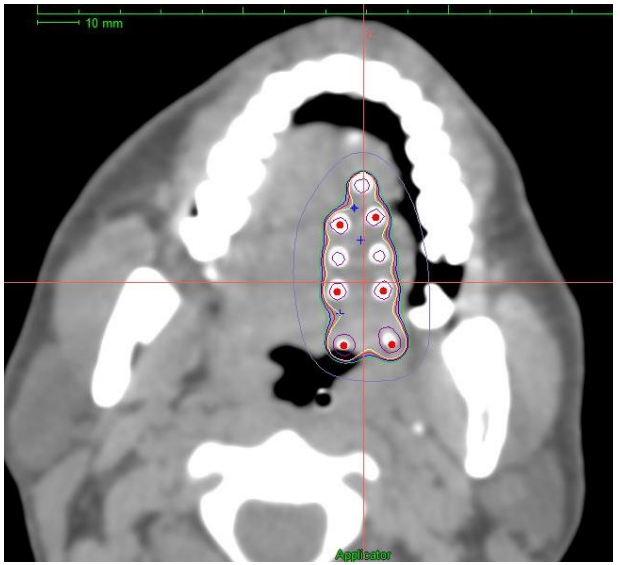


- Early stage disease:
    - Radical External beam RT
    - Radical Brachytherapy
    - Combined External beam RT+ Brachytherapy
- Advanced Stage disease:
    - Definitive RT+CT
    - Adjuvant RT+/- CT
    - Palliative RT

Brachytherapy

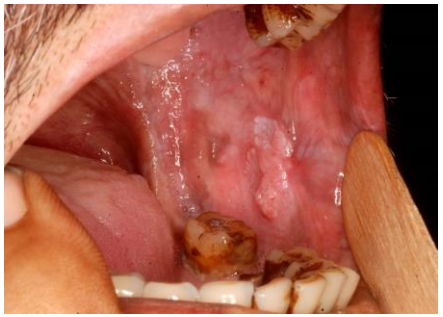
"Placement of sealed radioactive sources into or immediately adjacent to the target tissue is called as brachytherapy."



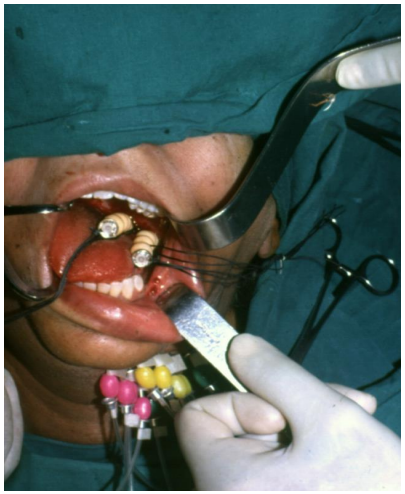


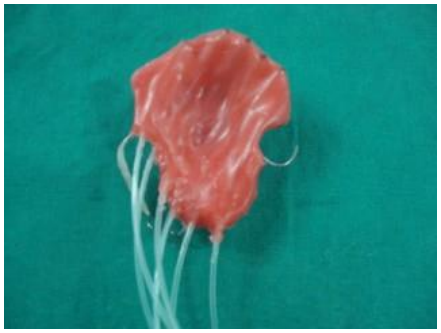
Oral cavity: Sites for brachytherapy

- Lip
- Buccal Mucosa
- Tongue
- Floor of mouth
- Hard palate



Types of Brachytherapy





Interstitial Brachytherapy

Radioactive sources are placed directly into the site of the tumor

-Lip, buccal mucosa, tongue, floor of mouth

Surface Mould Brachytherapy

Radioactive sources are placed on the surface of the tumor

Hard Palate

Types of Brachytherapy

- Radical Brachytherapy alone:
  - Lip
  - Buccal Mucosa
  - Hard Palate
  - Tongue
- Boost Brachytherapy:
  - Tongue
  - Floor of mouth

- Low dose rate brachytherapy:
  - Low doses of radiation given over 5-6 days
  - Dose rate: 0.4Gy-2Gy/hr
- High dose rate brachytherapy:
  - High doses of RT given in short time
  - Dose rate: >12Gy/hr

Patient Selection

- T1, T2 tumors
- Node negative
- Accessible for brachytherapy
- Adequate mouth opening
- Lesions not very close to bones

Patient Selection: Oral Cavity

Site	Brachytherapy Alone	Ext RT+ BRT
Lip	Tumors <5cm	Larger tumors
Buccal Mucosa	Tumor <4cm, thickness <1.5cm	Larger tumors
Tongue	Upto 3cm,N0	>3-4cm, N1
Floor of mouth	T1N0M0	>3-4cm, N1

Mazeron J et al. Radiother Oncol 2009

Pre-Treatment Assessment

Primary Tumor:

Exact extent of tumour to be determined- Tumor Mapping

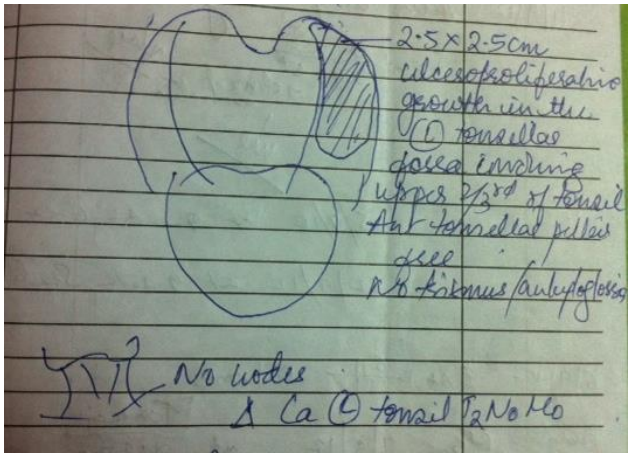
Clinical examination, EUA- to assess mucosal extensions

Depth assessment important.

Imaging: CT scan/ MRI.

r/o other lesions in the region (synchronous 2nd primary).

- Neck Assessment
  - Clinical examination
  - USG neck
  - CT/MRI

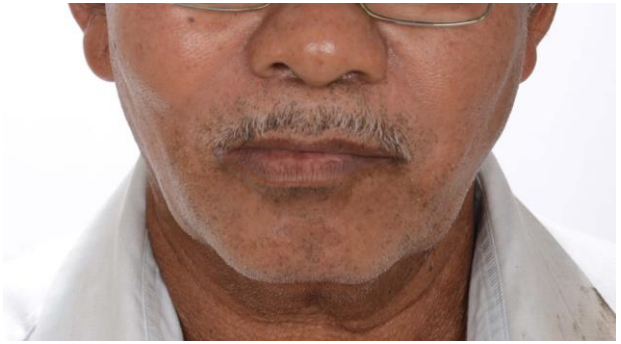


Brachytherapy Procedure

- Procedure done under general anesthesia
- Head extended, ring under head &towel roll under shoulder
- Nasal Intubation (opposite Nostril)
- Cuffed endotracheal tube
- Ryles tube placement before the placement of catheters
- Tongue stitch
- Throat pack (Remember to Remove!)
- Evaluation Under anesthesia

Case Capsule

60 years male, P/w growth over right buccal mucosa since 6 month



O/E: GC good, KPS 90.

Neck - No nodes palpable.

Oral cavity: Mouth opening adequate.

Ulceroproliferative growth of size 3x2cm in the right buccal mucosa from the oral commissure to the 1st molar, superior and inferior GBS free.Skin free.

Hopkins: NED

Final diagnosis: Ca Rt Buccal mucosa cT2N0M0 Stage II

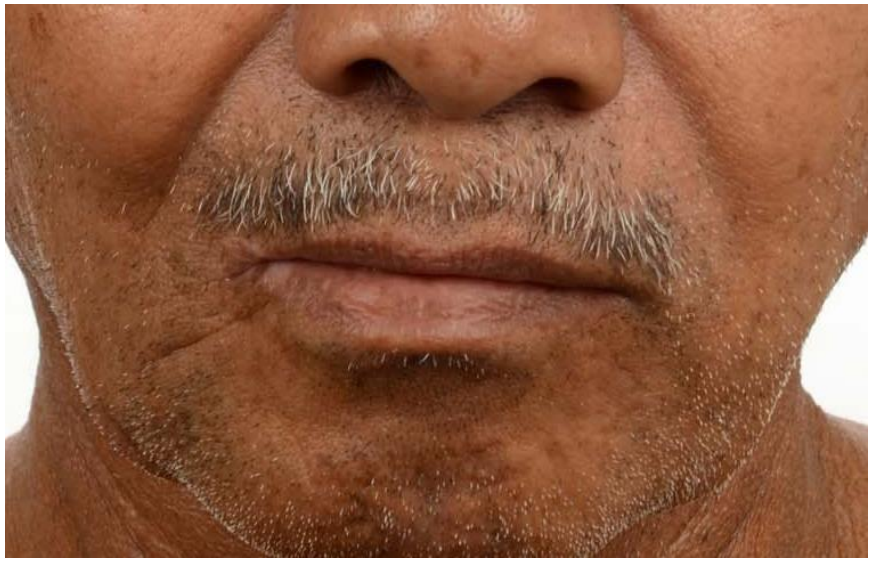
Plan: Radical Brachytherapy.

Technique: Buccal Mucosa Cancer

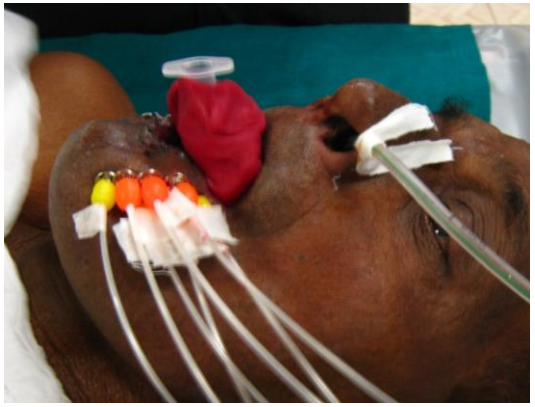
Care During Procedure

- **Prevent / Treat infection**
  - Meticulous hygiene
  - Prophylactic antibiotics in some cases
  - Topical antibiotics at entry and exit site
  - Change dressing once daily
- **Prevent Bleeding**
  - Careful selection of the needle route
  - Avoid multiple punctures
  - Use pressure to stop bleeding
- **Pain Control**
- **Steroids**

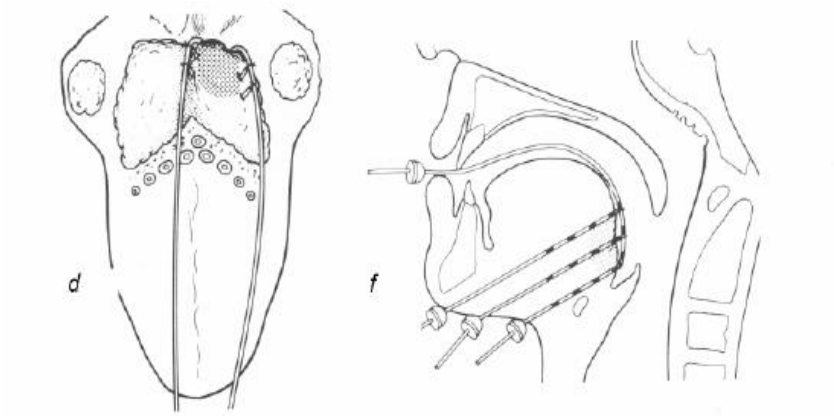
Post RT 1.5 yrs

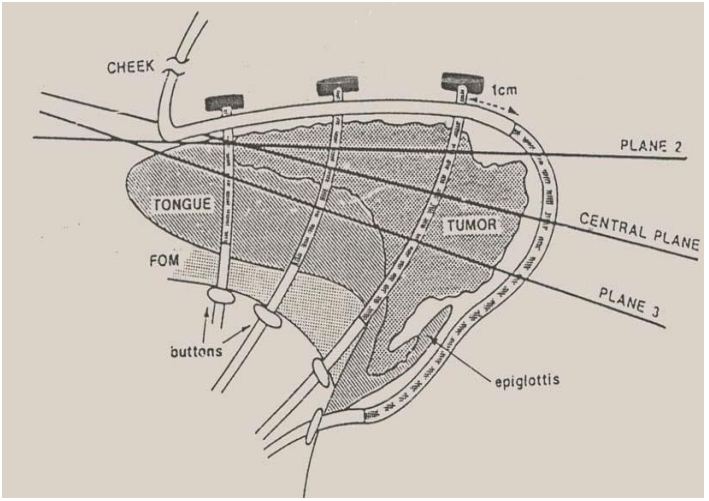


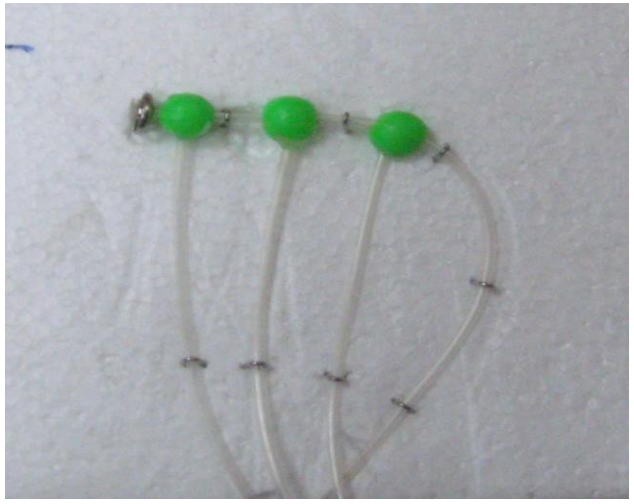
Technique: Lip Cancers



Technique: Tongue cancers

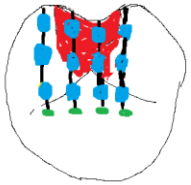




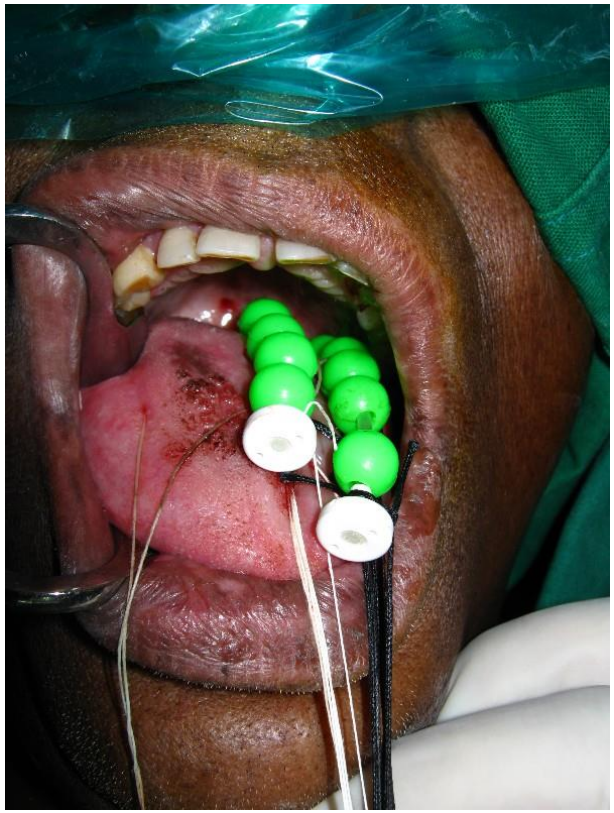


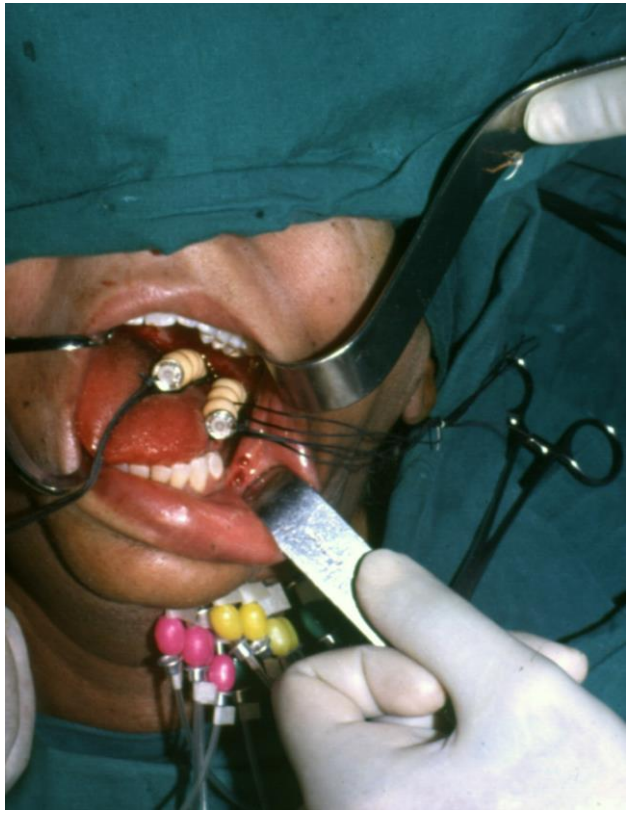
Anteroposterior Loops

HDR source can negotiate well

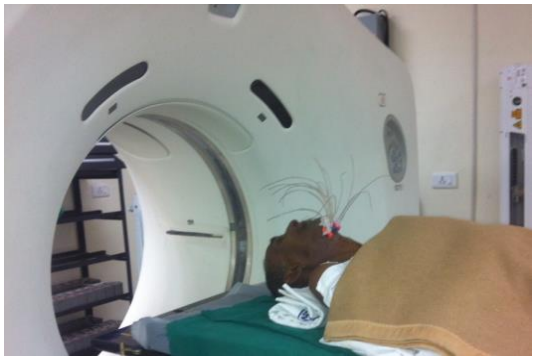


Brachytherapy Technique For Anterior Tongue



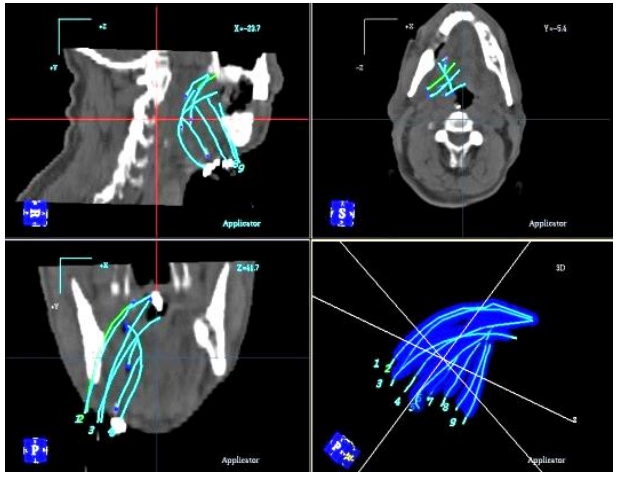


3D CT Based Planning

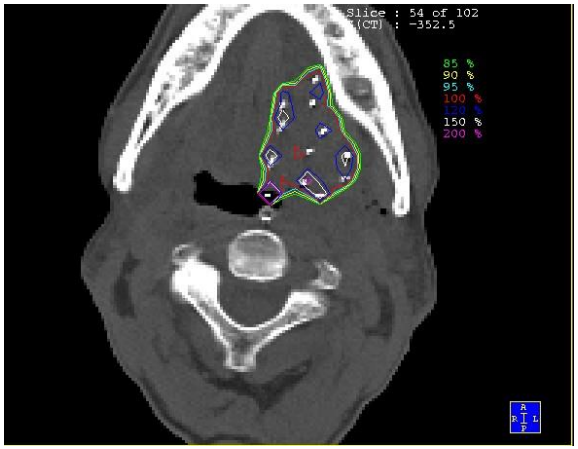


RT planning CT scan

Catheter Measurement



Catheter Reconstruction



Dose Distribution

Treatment Delivery

High Dose Rate Brachytherapy

Two fractions given every day

6 hours apart

Dose: 300-400cGy

Total dose:

Radical:

Equivalent of 60-66Gy of low dose rate brachytherapy

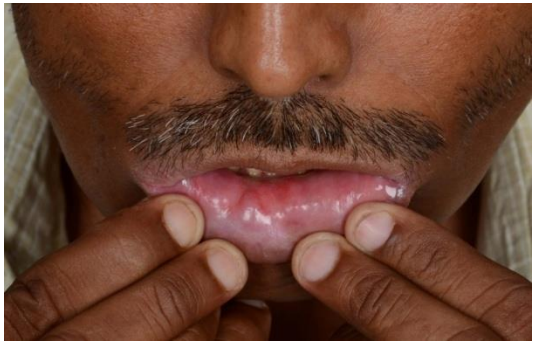
350cGy/# bid X 14 (4900cGy), 400cGyx12/13 (4800cGy/5200cGy)

Boost:

Equivalent of 20-30Gy of low dose rate brachytherapy

3Gy per fraction bid X7-8 (2100-2400cGy

Clinical Outcomes: Lip Cancer

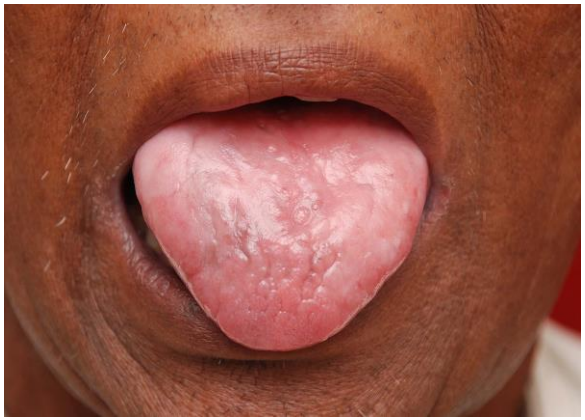


Organ Preservation

Function Preservation

Excellent Cosmesis

Clinical Outcomes: Tongue Cancer



Clinical outcomes: Lip Cancer

Author	*n*	Dose (Gy)	LDR	HDR	PDR	5 years local control (%)	5 years OS (%)	Toxicity
Beauvois *et al.* [21]	237	65-68	^{192}Ir	–	–	95	74	9.5% necrosis
Gerbaulet *et al.* [22]	231	76	^{192}Ir	–	–	95	n.d.	13.0% necrosis
Tombolini *et al.* [24]	57	62	–	HDR	–	90 (10 yrs)	n.d	n.d.
Guinot *et al.* [26]	104	9 × 5.0 bid	–	HDR IMBT	–	95.2	64.4	0%
Lock *et al.* [173]	51	55	^{198}Au	–	–	97.8	87.9	Good cosmesis 48/51
Serkies *et al.* [25]	32	60-70	–	–	PDR	98		2/32
Johannson *et al.* [20]	43	60	–	–	PDR	94.5 (10 yrs)	58.9 39.1 (10 yrs)	2% soft tissue necrosis 2% bone necrosis

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Clinical Outcomes: Tongue/FOM

Author	*n*	Anatomic site	Dose (Gy)	LDR	HDR	PDR	5 years local control (%)	5 years OS (%)	Toxicity
Pernot *et al.* [35]	552	Mobile tongue	70-75	^{192}Ir, wire	–	–	St. I: 95 St. II: 65 St. III: 54 St. IV: 36	St. I: 71 St. II: 43 St. III: 33 St. IV: 23	Grade I: 20% Grade II: 9% Grade III: 4% Grade IV: 0.2%
Pernot *et al.* [35]	207	Floor of mouth	70-75	^{192}Ir, wire	–	–	St. I: 97 St. II: 73 St. III: 64 St. IV: 0	St. I: 74 St. II: 46 St. III: 39 St. IV: 0	Grade I: 20% Grade II: 9% Grade III: 4% Grade IV: 0.2%
Yoshida *et al.* [46]	70	Mobile tongue	70	^{192}Ir ^{226}Ra ^{60}Co	–	–	78 71 (10 yrs)	80 CSS 72 (10 yrs) CSS	n.d.
Inoue *et al.* [39]	58	Mobile tongue	6 × 10	–	HDR	–	T1/T2 = 82/79	T1/T2 = 83/82, CSS	10%
Inoue *et al.* [39]	341	Mobile tongue	70	^{192}Ir ^{226}Ra	–	–	T1/T2 = 85/80	T1/T2 = 85/79, CSS	6%
Marsiglia *et al.* [49]	160	Floor of mouth	60-70	^{192}Ir, wire	–	–	T1/T2 = 93/88	76	18% bone necrosis 10% soft tissue necrosis
Strnad *et al.* [62]	67	Floor of mouth	50-64	–	–	PDR 24 hours	Approx. 87	Approx. 77	9.7% soft tissue necrosis 7.2% bone necrosis
Strnad *et al.* [62]	103	Mobile tongue	50-64	–	–	PDR 24 hours	Approx. 78	Approx. 67	9.7% soft tissue necrosis 7.2% bone necrosis
Guinot *et al.* [43]	50	Mobile tongue	11 × 4	–	HDR IMBT bid	–	79	70	4% bone necrosis 16% soft tissue necrosis
Yamazaki *et al.* [45]	80	Mobile tongue	6 × 10	–	HDR bid	–	T1/T2/T3 82/79/89	T1/T2/T3, CSS 86/781/89	T1/T2/T3 17%/20%/0%

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BT in Tongue Cancers

Author (year) Institute	¶n	T category	§Schedule	†Local control	Toxicity	Remark
Yamazaki (2003) [22] T1–2N0 Bx only	58 HDR	22T1, 36T2	Bx only: 6 Gy × 8–10	84%	S2%, B2%, both 1%	HDR ≃ LDR in T1–2
	341 LDR*	171T1, 170T2	Bx only: 70 Gy (6–84 Gy)	80%	S3%, B3%, both 1%	
Yamazaki (2007) [23] T1–2N0	80 HDR	24T1, 47T2, 9T3	EBRT: 37 Gy ± Bx: 6 Gy × 6–10	87%T1, 79%T2, 89%T3	Bx 19%, Bx + EBRT 29%	HDR ≃ LDR in T1–3
	217 Ra–226	77T1, 103T2, 37T3	EBRT: 29 Gy ± Bx: 72 Gy (59–94 Gy)	85%, 75%, 62%	Bx 9% Bx + EBRT 24%	EBRT elevated toxicity
	351 Ir–192	111T1, 202T2, 38T3	EBRT: 30 Gy ± Bx: 72 Gy (59–94 Gy)	79%, 73%, 64%	Bx 10%, Bx + EBRT 28%	
Kakimoto (2001) [24] T3N0–2	14 HDR	All T3	EBRT: 30 Gy (12.5 – 60 Gy) ± Bx: 6 Gy × 10	71% (2 y)	S21% B0%	HDR ≃ LDR in T3
	61 LDR Ir–192		EBRT: 30 Gy (12.5–60 Gy) ± Bx: 72 Gy (5 –94 Gy)	67% (2 y)	S5% B20%	
Akiyama (2012) [25] T1–2N0 60 Gy vs 54 Gy	17 54 Gy arm	7T1, 10T2	Bx only: 6 Gy × 10	88% (2 y)	S0%, B6%, both 12%	6 Gy × 9 ≃ 6 Gy × 10
	34 60 Gy arm	16T1, 18T2	Bx only: 6 Gy × 9	88% (2 y)	S3%, B3%, both 6%	

Yamazaki H et al, Jl of Radiat Res, 2013, 54, 1–17

GEC ESTRO Recommendations

Radiotherapy and Oncology 122 (2017) 248–254

Contents lists available at ScienceDirect

Radiotherapy and Oncology

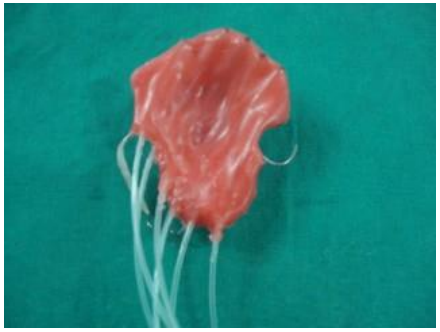
journal homepage: www.thegreenjournal.com

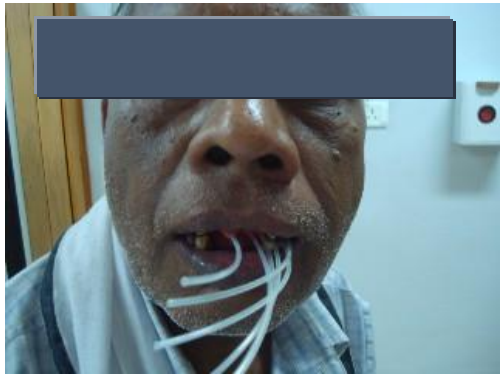
GEC-ESTRO/ACROP recommendations

GEC-ESTRO ACROP recommendations for head & neck brachytherapy in squamous cell carcinomas: 1st update – Improvement by cross sectional imaging based treatment planning and stepping source technology

György Kovács [a,*,1], Rafael Martinez-Monge [b,1], Ashwini Budrukkar [c,1], Jose Luis Guinot [d,1], Bengt Johansson [e,1], Vratislav Strnad [f,1], Janusz Skowronek [g,h,1], Angeles Rovirosa [i,1], Frank-André Siebert [j,1], on behalf of the GEC-ESTRO Head & Neck Working Group

Surface Mould Brachytherapy





Clinical Investigations

Original paper

Clinical outcomes with high-dose-rate surface mould brachytherapy for intra-oral and skin malignancies involving head and neck region

Ashwini Budrukkar, MD[1], Archya Dasgupta, MD[1], Prakash Pandit, MD[1], Sarbani Ghosh Laskar, MD[1], Vedang Murthy, MD[1], Ritu Raj Upreti, MSc[2], Tejpal Gupta, MD[1], Kanchan Dholam, MDS[3], Jai Prakash Agarwal, MD[1]

[1]Department of Radiation Oncology, [2]Department of Medical Physics, [3]Department of Dental Services, Tata Memorial Hospital, Parel, Mumbai, India

35 patients –surface tumors of head and neck region

21 Intra-oral, 14 Skin tumors

Intra-oral: EBRT+Boost

Skin: Radical Brachyherapy

Brachytherapy doses:

Radical : 49Gy/14# @ 3.5Gy bid regimen

Boost: 21Gy/7fraction@ 3Gy bid regimen

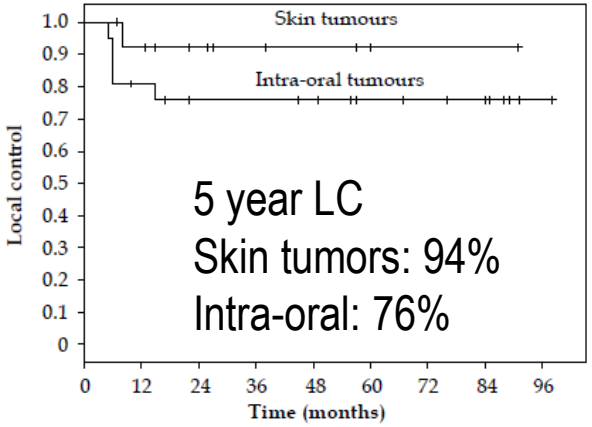


Fig. 3. Kaplan Meier plot showing local control in patients treated with surface mould brachytherapy for head and neck cancers

Median follow up: 52 months

Surgery vs Brachytherapy

Brachytherapy

- Angle of mouth
- Lower lip
- Anteriorly placed buccal mucosa lesions
- Hard palate
- Better functional and cosmetic outcome

Surgery

- Posteriorly placed lesions
- Lesions close to bone
- Lesions involving upper/ lower GBS
- Comparable control rates

Acknowledgements

- **Radiation Oncology**
  - V Murthy
  - JP Agarwal
  - SG Laskar
  - M Swain
  - N Mummudi
  - RL Bhalavat
- **Medical Physics**
  - S Kale
  - R Upereti
  - U Upereti
  - P Sahoo
- **Head and Neck Surgeons**
  - P Pai
  - G Pantvaidya
  - A Deshmukh
- **RT Technologist**
  - V Somesan
  - K Patil
  - S Kolhe
- **RT Residents**