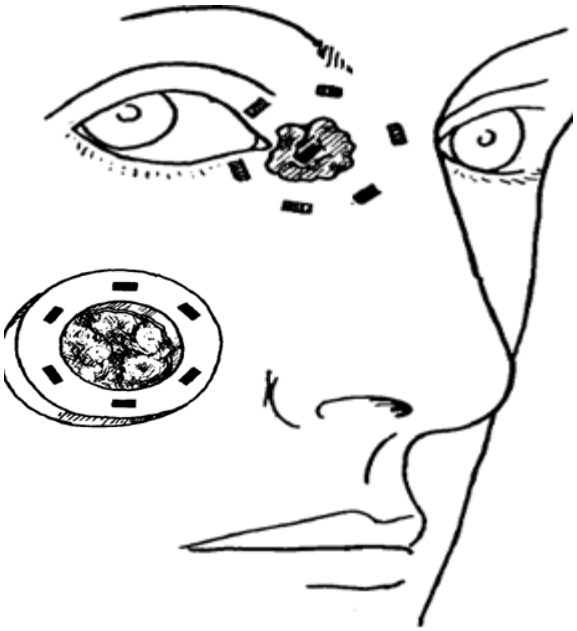
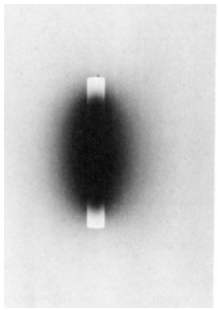
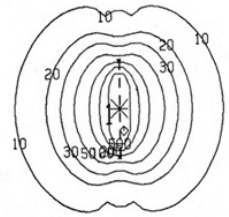






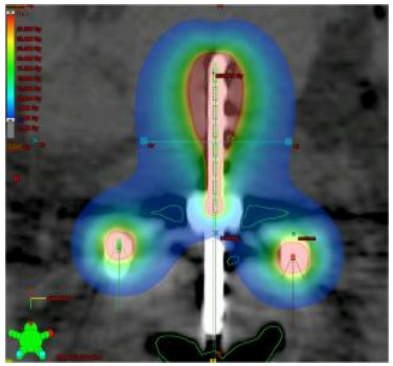
SURFACE MOULD BRACHYTHERAPY

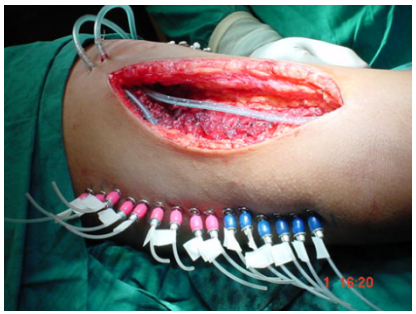
Brachytherapy

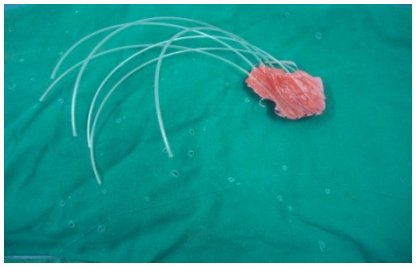
Brachytherapy consists of placing sealed radioactive sources very close to or in contact with the target tissue

TYPES

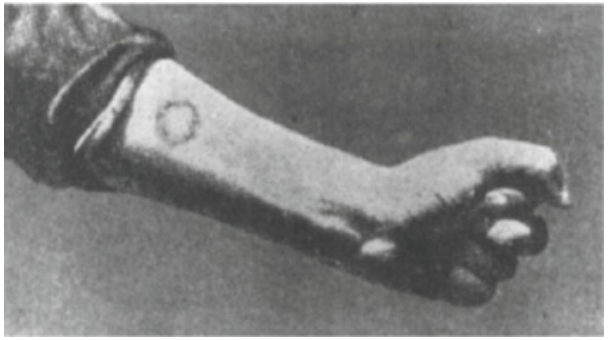
1. *Intracavitary*
2. *Interstitial*
3. *Intraluminal*
3. *Surface-Application*



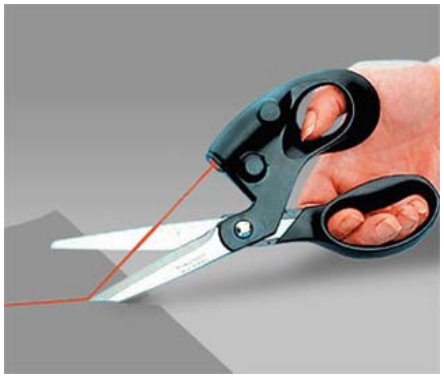


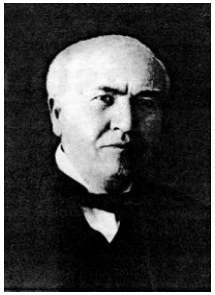


Simple Idea : Great Inventions



Friedrich Giesel October 1900,





First **surface application** 1901
Dr Henri Danlos (Hospital St-Louis,Paris),
Lupus rather than for **skin cancer**

Dr. William (USA) reported his experience 1904
“one of acne, two of psoriasis, five of lupus vulgaris, two of lupus erythematosus, two of eczema, one of keloid, **five of rodent ulcer, 28 of epidermoid carcinoma and four breast cases.”**

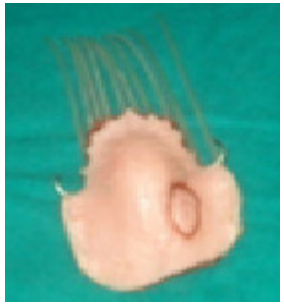
"I never did a day's work in my life, it was all fun“

Danlos H, *Ann Dermatol Syphilog 1901;2:986–8.*
Williams FH. *Boston Med Surg J 1904;150:206–9.*

SURFACE APPLICATION

Consists of **applicator containing an array** of radioactive sources usually designed to deliver a uniform dose distribution to a skin/mucosal surface




•To deliver a reasonably homogenous dose to a surface.

•To give dose up to a particular depth with steep dose fall beyond <===> Particle therapy ? Electron therapy

SURFACE APPLICATION

Why Still Attractive!

PATIENT FRIENDLY

Patient is not restricted to bed
No anesthesia
No pain or trauma
Better cosmesis
Easy convalescence

OTHER BENEFITS

No tissue injury
No risk of tissue sepsis
No risk of transplantation of tumour cells
Dose is more uniform than interstitial implant

SURFACE MOULD APPLICATION

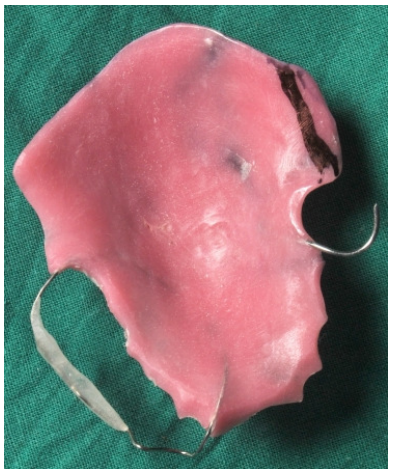
PRE-REQUISITES

Tumour

- Accessible site
- Well defined margins.
- Superficial (2-3mm)
- No regional or distant spread

SURFACE MOULD APPLICATION

PRE-REQUISITES

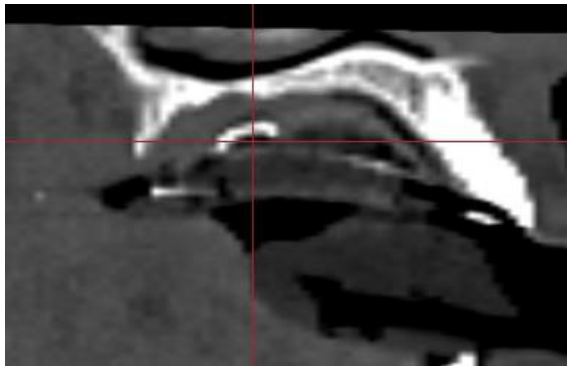


Surface Applicator/Carrier

Light Weight

Snugly/Accurate Fit,

Retained In Place



SURFACE MOULD APPLICATION

PRE-REQUISITES

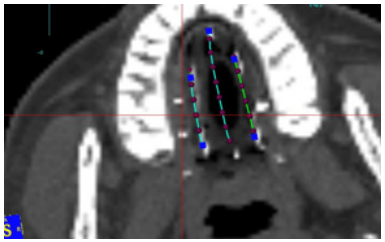
Securing of Radiation Source/ Catheters

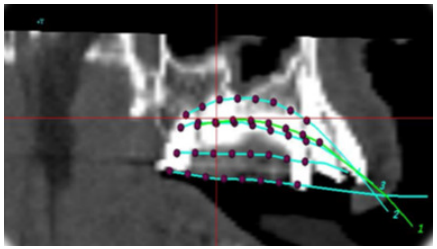
Source to surface distance must be maintained accurately all throughout

Mould = Carrier & Source

The carrier radium times…. Preloaded era

1. Press wool, elastoplasts
2. Wax – not preferred as source got stuck !!
3. Perspex :hard; shape prepared as per area required





SURFACE MOULD APPLICATION

Radium dosage…

Amount of Radium depends on:

- ✓ Desired Exposure
- ✓ Area treated
- ✓ Treating Distance(h)
- *1000R (Roentgen) was taken as clinical working unit*
- Charts were prepared to show in milligram-hrs the amount of radium required on applicators to give 1000R over an area to a treating distance (h)

SURFACE MOULD APPLICATION

Radium dosage…

Treating Distance (cm)

AREA (sq cm)	0.5	1.0	1.5	2.0	2.5
0 - 1	30	119	268	476	744
2	97	213	375	598	865
4	141	278	462	698	970
6	177	333	536	782	1066
8	206	384	599	855	1155
10	235	433	655	923	1235

FIG : *Milligram Hours per 1000R for moulds of different areas and treating distances*

SURFACE MOULD APPLICATION

Radium dosage…Example?!

If an area of 8 sq cm is to receive 6000R over 50 hours for a mould for which *h = 1.0 cm;*

mgh per 1000R for 8 sq cm and *h* = 1 is **384**

Thus, for 6000 R : 6 x 384 = 2304 mgh is needed

Thus, radium reqd. for 50 h treatment = 2304/50

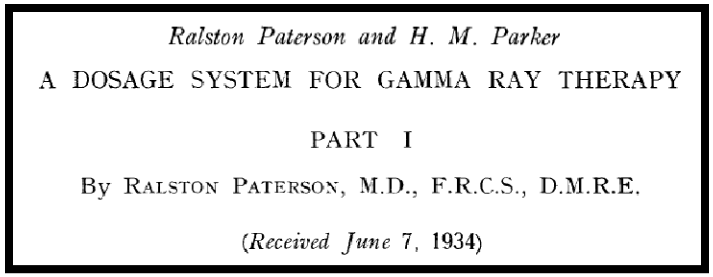
= **46.08 mg**

SURFACE MOULD APPLICATION

Classes of Moulds: Basis of Geometry

Classically the **Rules** were defined according to **Manchester system** for distribution of **Radium source**

Uniform dose coverage of whole lesion with margin in all directions by single isodose (< 10% variation)



Ralston Paterson and H. M. Parker

A DOSAGE SYSTEM FOR GAMMA RAY THERAPY

PART I

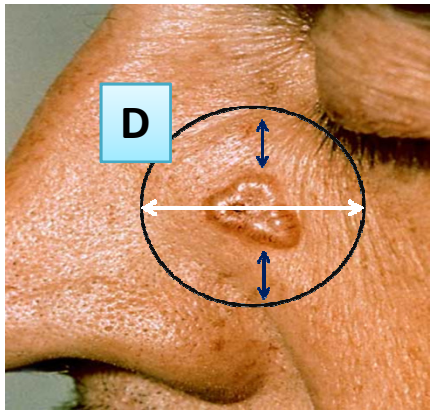
By RALSTON PATERSON, M.D., F.R.C.S., D.M.R.E.

(*Received June 7, 1934*)

SURFACE MOULD APPLICATION

BASICS OF THE RULES

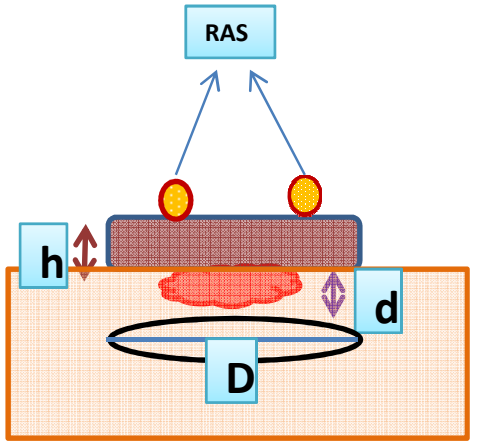
Dimensions Of Rx Area To Be Treated = Lesion + Margin (Approx Circular Area Of Diameter D)



D= diameter
h= applicator thickness
d= depth to be treated

For all classes;

1. Thickness of carries = distance of source to surface , depends on depth to be treated (assessed clinically)
1. Approx *distance = 2 x depth* ***(h=2 Xd)***



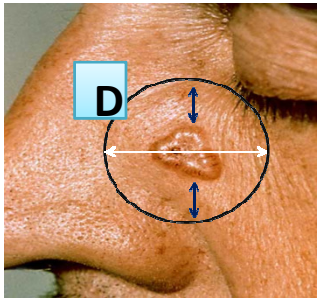
SURFACE MOULD APPLICATION

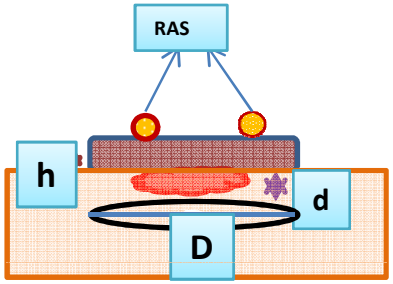
Planer Geometry Of Arrangement

CIRCLES

Optimal technique

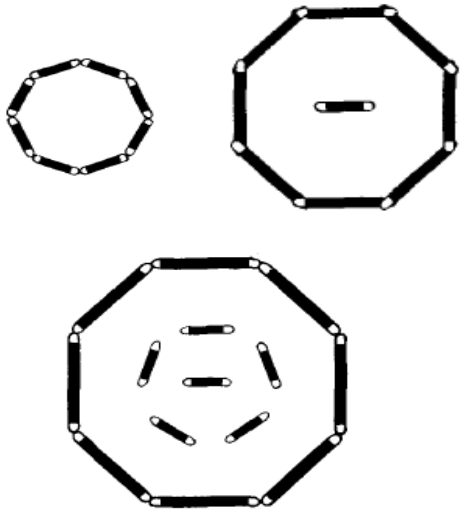
The Radium sources (RAS) placed circumferentially around lesion





h= applicator thickness
d= depth to be treated
D= diameter

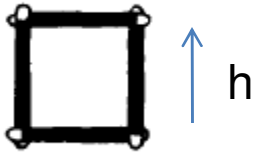
D/h % Radium	< 3	3 to <6	6 to <7.5	7.5 to <10	10
Outer circle	100	95	80	75	70
Inner circle	0	0	17	22	27
Centre spot	0	5	3	3	3



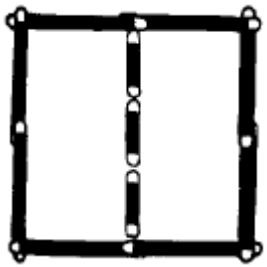
SURFACE MOULD APPLICATION

Planer Geometry Of Arrangement

Square … Rectangle



RAS in line around the periphery with uniform linear density
If length of one side = 2 h, NO further radium needed.
Additional lines are added parallel to the side to divide area into strips of width=2 h



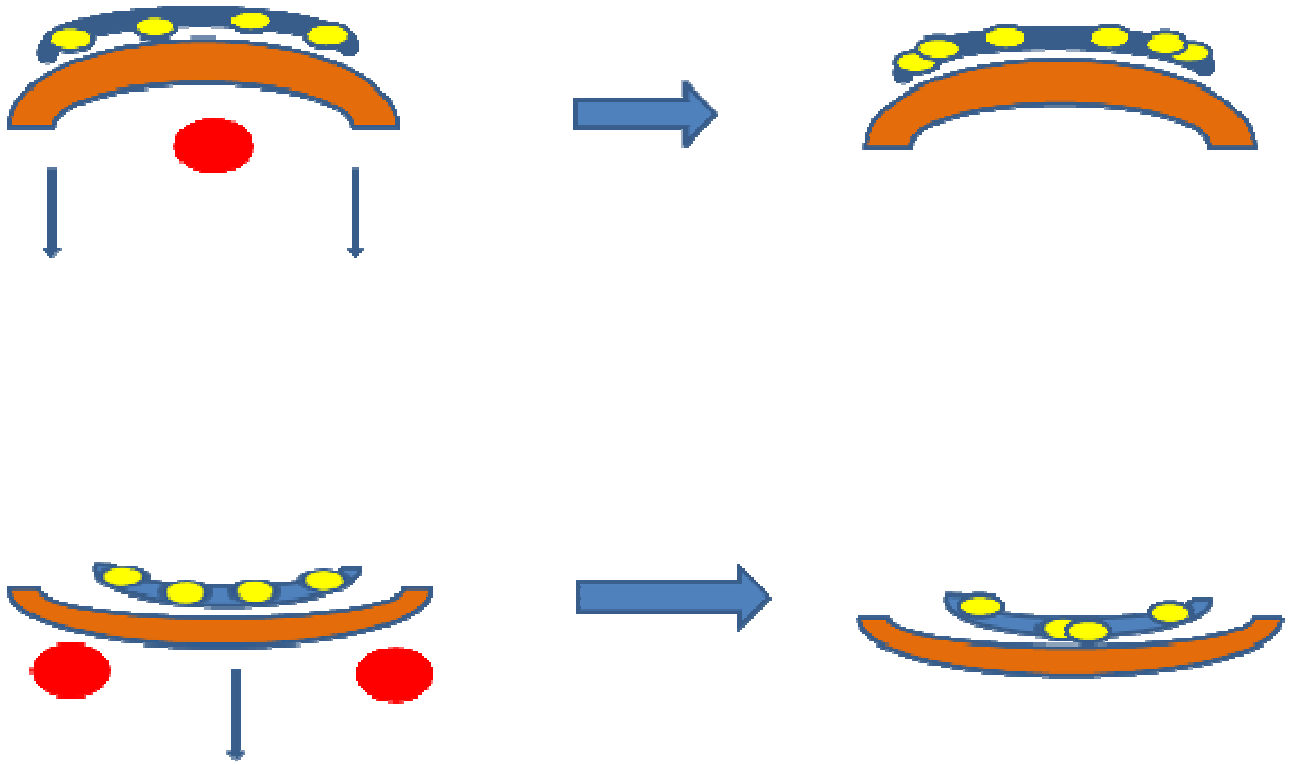
One added line : Linear density 1/2 of periphery
Two added lines: Linear density 2/3 of periphery

Ratio of sides of rectangle	2 : 1	3 : 1	4 : 1
Percentage to be added	5%	9%	12%

SURFACE MOULD APPLICATION

Planer Geometry Of Arrangement

SPECIAL SITUATIONS : Curved Surface



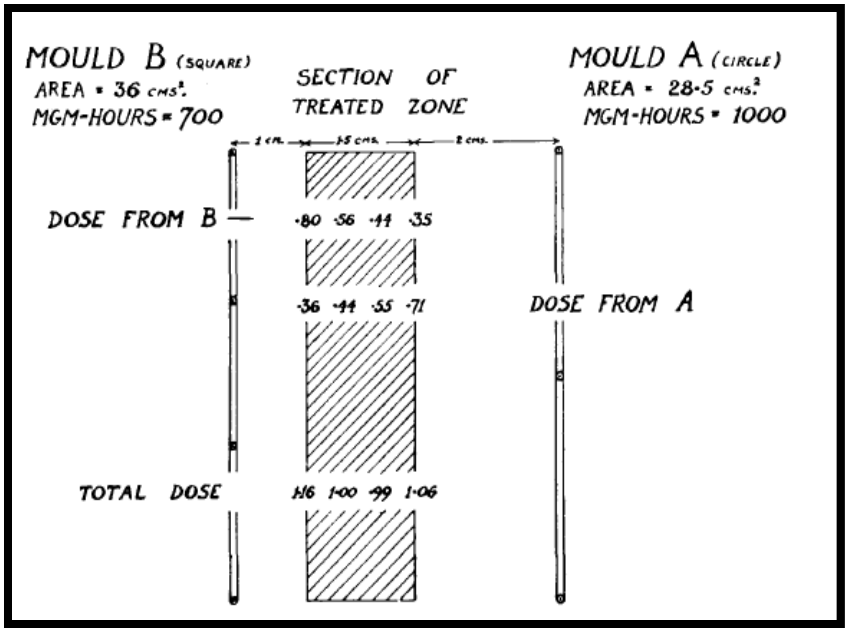
SURFACE MOULD APPLICATION

Planer Geometry Of Arrangement

SPECIAL SITUATIONS : Sandwich Technique

Tissue Open On Both Sides: Lip, Pinna

Fall in intensity of doses can be from one mould balanced by other



SURFACE MOULD APPLICATION

Modern Times ……. Need for a Change!!!

Change In Carriers Material Polyacrylate/ Polymethylmethacrylate Preloaded To Afterloading
Change In Sources : Radium To Iridium (LDR <>HDR)

Human Safety And Precision

- Free style
- Based on Manchester system of rules
- Stepping source dosimetry: optimize (Effective Activity, Time)
- *Rules* – parallel catheter with STEP source loading : distance (0.8 – 1.2 cm gap). Aprrox 1 cm beyond the lesion in all direction, follow the contour of lesion equidistant from surface at all levels
- Total dose – 60 Gy (LDR EQUIVALENT)
- Fractionation – 3-4 Gy / # with 2 # per day 6 hr gap

SURFACE MOULD APPLICATION

Modern Times …….How do we do it !!!

55 Yr /Male / Chronic tobacco chewer/
2X2 cm well defined ulcer in hard palate, no nodes
Bx- squamous carcinoma
Diagnosis : Ca Hard Palate T1N0M0

Explain Procedure/ Informed consent
Communicate with Team >>>>>

Comfortable patient positioning

Lesion to be marked with indelible ink

Impression of lesion and surrounding structures taken with dental compound

Ensure accurate fitting of the surface applicator

SURFACE MOULD APPLICATION

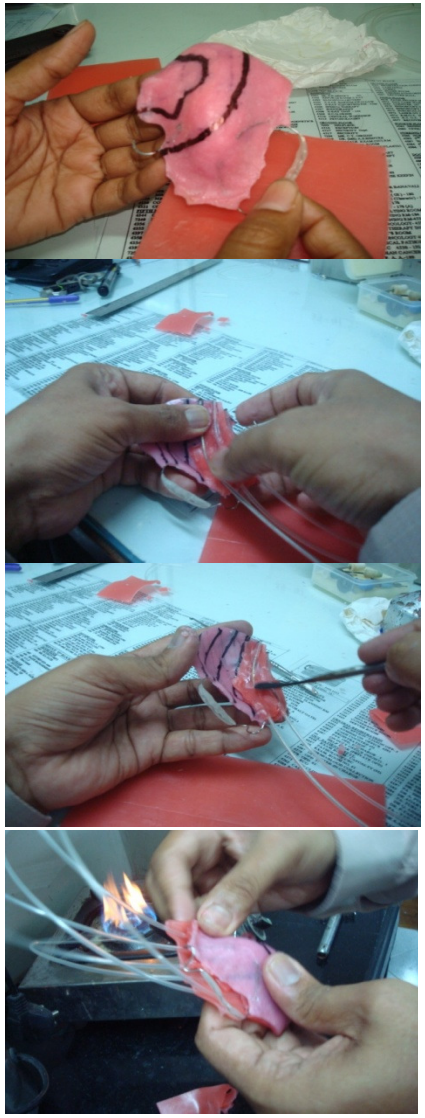
Modern Times …….How do we do it !!!

Marking of the exact area to be treated on the mold
Thickness of mould < = 2mm

Wax build up(thickness) applied on inner surface of applicator (total Rx distance 5 mm)

Catheters placed parallel, equidistant beyond lesion (0.8 – 1.2 cm spacing)

Another layer of wax put to cover catheters firmly secured in position & to push normal structures away
Number/ flag the catheters



SURFACE MOULD APPLICATION

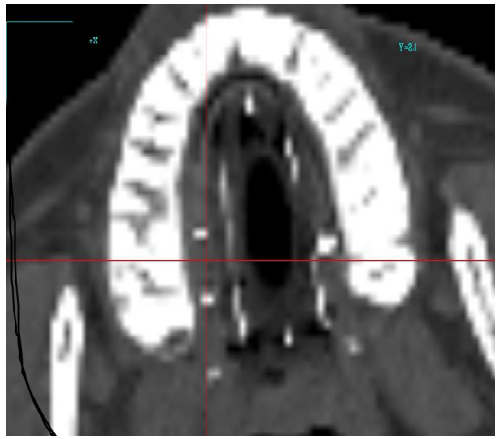
Modern Times …….How do we do it !!!

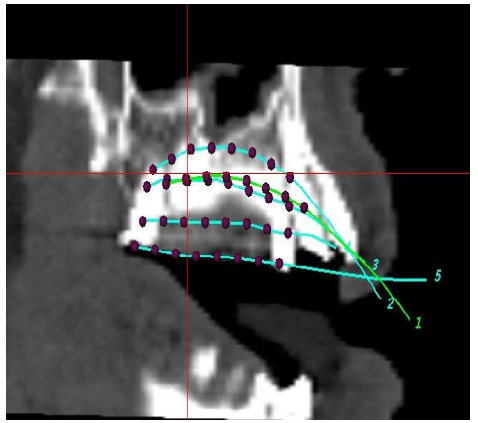
Applicator is applied on to patient check comfort of patient May repeat several times till accustomed.

Planning CT cuts taken(3 mm) the region of interest & transferred to planning system

All catheters are tracked and set in axis

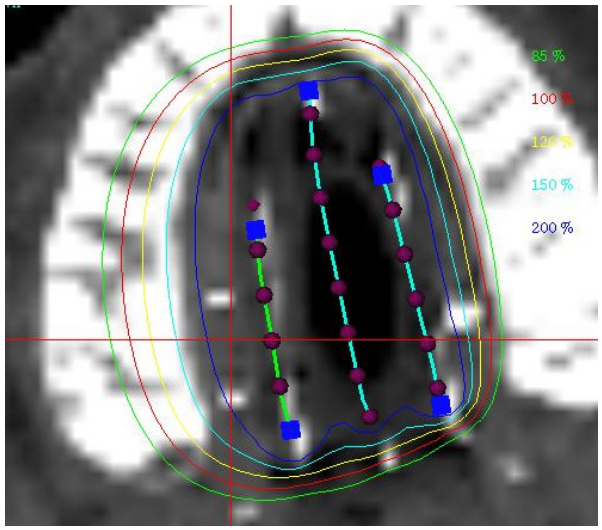
Source loading done from tip end of catheter (stepping source)

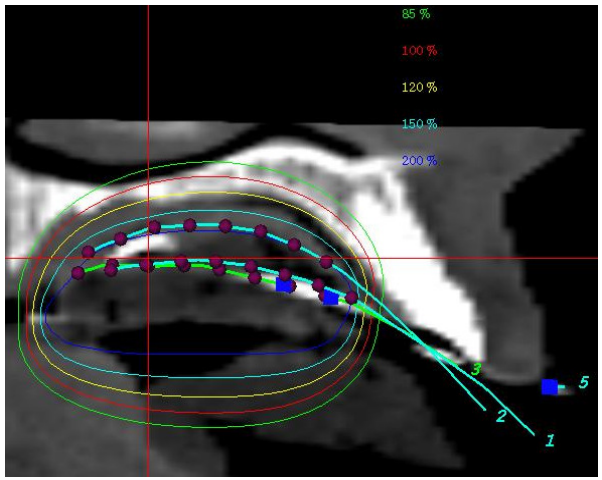




SURFACE MOULD APPLICATION

Modern Times …….How do we do it !!!





Evaluate plans

Dose is prescribed at 85% reference isodose level (GREEN)

Or at a certain depth/ dose points

Optimization done to get ideal dose distribution

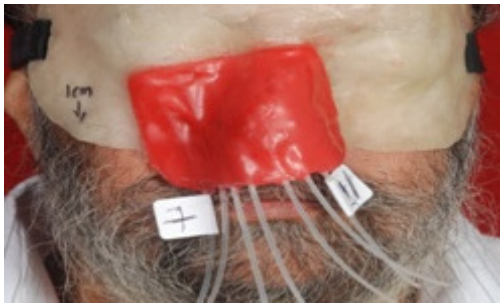
Remove applicator

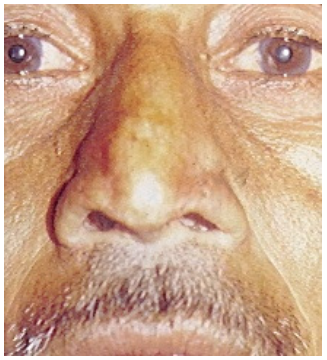
Rinse in free flow water

Keep it safe for next application

SURFACE MOULD APPLICATION

Modern Times …Pictures say it all !!





Explain and reinforce

Oral / Skin hygiene,
Time of onset acute reactions
Medications,
Follow up surveillance

SURFACE MOULD APPLICATION

Literature review

TREATMENT OF SKIN CARCINOMAS OF THE FACE BY HIGH-DOSE-RATE BRACHYTHERAPY AND CUSTOM-MADE SURFACE MOLDS

BENJAMIN GUIX, M.D., PH.D., M.B.A.,* FERNANDO FINESTRES, M.D.,* JOSÉ-IGNACIO TELLO, PH.D.,* CÉSAR PALMA, M.D.,* ANTONIO MARTINEZ, M.D.,* JOSÉ-RAMÓN GUIX, M.D., PH.D.,* AND RICARDO GUIX, M.D., PH.D.*

*Department of Radiation Oncology. Fundació IMOR, Institut Mèdic d'Onco Radioteràpia, CORMEN sl. Universitat de Barcelona, Barcelona, Spain

Fractionated high dose rate brachytherapy moulds – a precise treatment for carcinoma of the pinna

Ernest Allan[a,*], Anthony Stanton[b], David Pye[c], Conor Collins[d], Lesley Perry[1e], Maeve Filby[2e], John Wilkinson[e]

Treatment of facial cutaneous carcinoma with high–dose rate contact brachytherapy with customized molds

Maria Maroñas[1], Jose Luis Guinot[1,*], Leoncio Arribas[1], Maria Carrascosa[1], Maria Isabel Tortajada[1], Ruth Carmona[2], Marian Estornell[1], Rodrigo Muelas[1]

SURFACE MOULD APPLICATION
Literature review

AUTHOR(Pt no.)	MEDIAN FOLLOWUP	LOCAL CONTROL	COSMESIS
Mazeron et al; 1988 (1676)	24 mths	< 2 cm = 96% 2.1 – 3.9 cm = 88% ➢ = 4 cm = 81% Radical= 95% Recurrent=88%	Not Reported
Rio et al; 2005 (97)	55 mths	97.4% DFS at 5y Radical = 91 % Post op = 80%	Good (70%)
Svoboda et al;1995 (130)	9 mths	100%	Excellent
Allan et al; 1998 (13)	18 mths	100%	Excellent
Maronas et al;2010 (51)	45 mths	89% at 5 yrs	Excellent

Adapted from Brachytherapy (10)2011:221-7

SURFACE MOULD APPLICATION

Conclusions

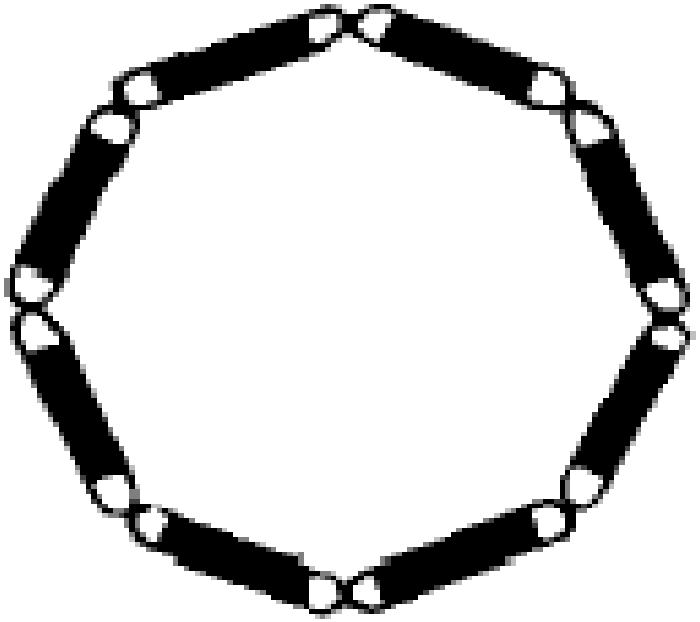
Excellent Non invasive treatment

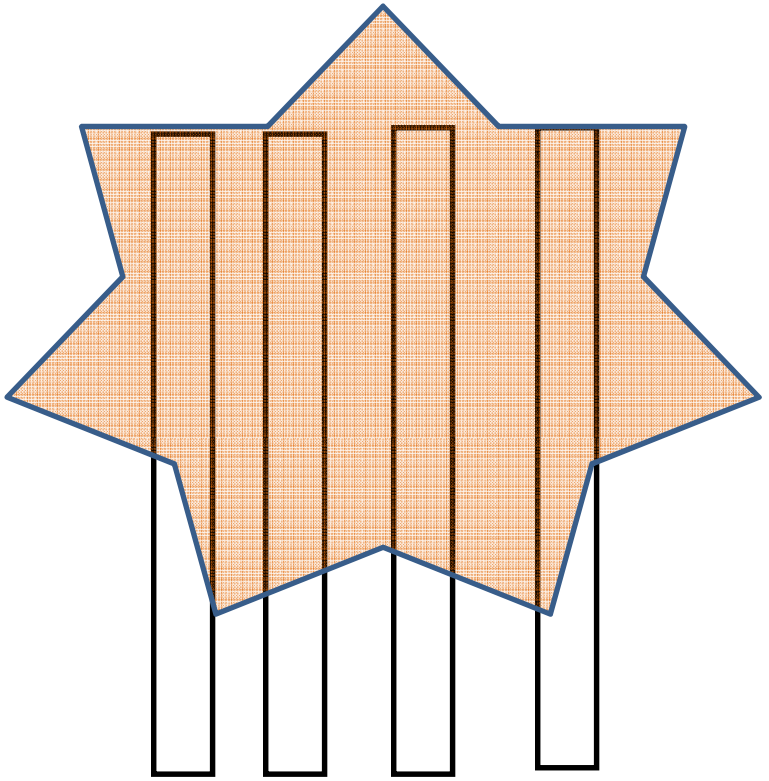
Short treatment times

Selection of patient is key
"success and good cosmesis"

Thank You

Food for thought…!





?????

Answer