Surface Moulds for the HDR MicroSelectron Afterloader

Mould Room Techniques

Part One: The Past, the Present & Future

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Synopsis

- The evolution of moulds from live source to afterloaded moulds progressing to current Scan & Plan technique using the Freiburg Flap
1905
Photograph showing the method of strapping on small tubes of radium to the skin to treat malignancies.

Transferred from en.wikipedia
(Original text: Metzenbaum, Myron (1905). "Radium: Its value in the treatment of lupus, rodent ulcer, and epithelioma, with reports of cases". International clinics (J.B. Lippincott) 4:14: 21-31.)
1922–1923 at the Institut Curie, Paris

a) Patient before radium treatment, March 1922.
b) Patient with radium applicator in the treatment position, February 1923.
c) Patient follow-up later in 1923.

Br J Radiol. 1998 Dec;71(852):1229-54. The discovery of radium in 1898 by Maria Sklodowska-Curie (1867-1934) and Pierre Curie (1859-1906) with commentary on their life and times.
Mould RP.
R. F. Mould
Birth of the Mould Room

- This is where we came from
- Radium first used in the 1900’s (first used in Manchester 1903)
- Moulds followed very quickly after that
- Mould rooms well established by 1920’s
Brachytherapy Moulds at Christie

• Moulds well established pre 1930’s
• Ralston Paterson visited Brussels 1932 returning with ideas for improvements
    Very detailed description of techniques
• Radium / Cobalt$^{60}$ Moulds continued until 1991
• 1991 MicroSelectron Afterloaded moulds
• 2013 Freiburg Flap introduced
Traditional Live Mould (Co$^{60}$)
Live Radium / Cobalt Moulds

- Long treatment times up to 8hrs per day / 8days
- Patient comfort issues
- Mould application and cleaning

- Radiation safety -
  - Staff / other patients
  - Source security

Most of these issues solved by afterloading technique
HDR Microselectron Mould
Advantages

• Afterloaded: No radiation hazard whilst fitting or servicing the mould. eg cleaning
• Short treatment time means patient comfort considerations in mould design less important.
  This may allow patient to tolerate more severe positioning
• Smaller source size allows tricky source placements
Traditional Mould – Treatment Height

Height and position of sources was critical

Combined Source/catheter diameter 2.00mm

Treatment height, d

Drilled post height / Platform height

Mould thickness
• Traditionally Paterson-Parker rules
• Moulds often scanned and planned allowing some variation in source dwell times

……but very little other flexibility in planning and treatment delivery!
Manchester Paterson-Parker system

- Traditional moulds impose fixed geometry as source position is fixed
- Mould accuracy was crucial as treating distance determined dose
- Little progression from historical moulds
- Not taking advantage of available technology scanning, planning, treatment delivery systems

- Pre-fixed array arrangement would allow more flexible planning approach
Treatment Sites

- Finger, Hand, Wrist, Forearm
- Leg
- Scalp
- Pinna
Freiburg Flap

- Aquaplast Custom Bolus used as spacer material over foundation shell
- Flexible Catheter array fixed to mould using nylon M4 bolts
Surface Moulds ……The Future

- Further development of usage of Thermoplastic material (pros & cons)
- Speed up adhesives method. Glue gun/ thermo setting adhesives
- 3D Printing is being explored elsewhere
3D Printed Patient-specific Surface Mould Applicators for Brachytherapy Treatment of Superficial Lesions

Ian Cumming et al
Laboratory for Percutaneous Surgery, School of Computing, Queen's University, Kingston, Ontario, Canada
CCSEO, Kingston General Hospital and Department of Oncology, Queen's University, Kingston, Ontario, Canada

To Be Continued……

Part Two
Practical aspects of Skin Surface Moulds