

Mohs surgery – for the histopathologist

Background

Mohs surgery is named after the general surgeon who pioneered this technique. Basically it is the intraoperative assessment of margins using frozen section shaves of the skin excision. Using this technique a minimal margin can be taken, rather than a standard 4mm margin. This means in sites of critical re-construction eg around the eye, nose, more tissue is preserved but the more significant benefit is a higher cure rate in recurrent tumours (Mosterd et al 2008 , 10% higher 5 year cure rate than standard surgery for recurrent tumours, 88% vs 98%).

This is currently offered in many centres around the UK, though this is increasing (figure 1)

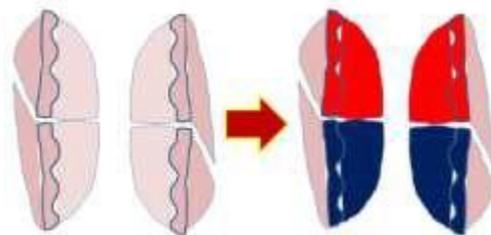
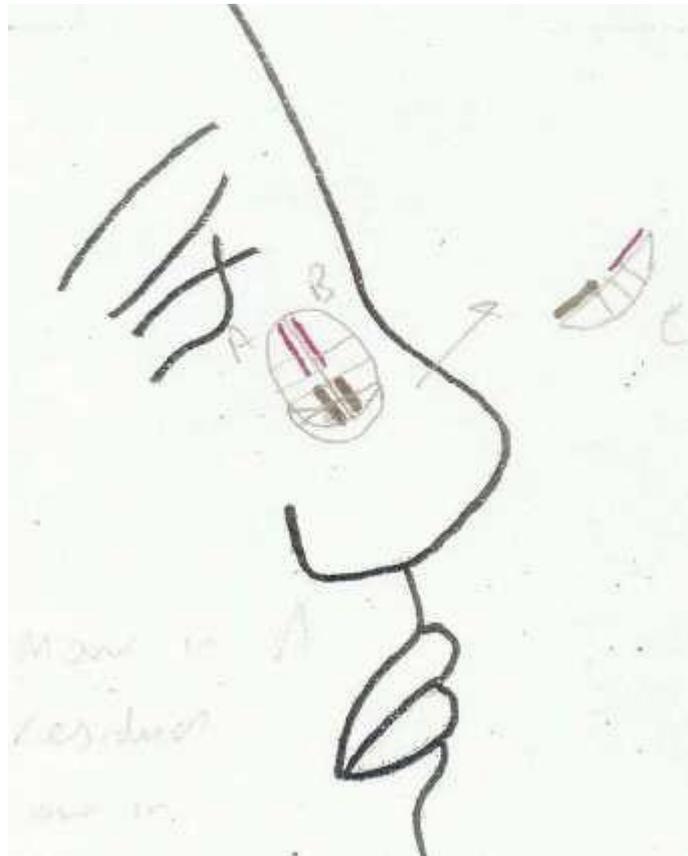
Figure 1: UK centres for Mohs surgery



What happens?

The surgeons will sometimes curette the lesion. The resistance to the curettage blade changes between tumour and normal skin. Curettage is also useful to debulk obvious tumour which helps to flatten down the specimen for assessment of the margins. Rather than curettage a small shave/scalpel excision maybe performed as this is more controlled and less likely to damage the epidermal edges. Following this the surgeon will then excise around this area. This generates a cup-shaped specimen, (rather like the case of a fairy cake). This is divided into smaller pieces to fit on the cryostat stages for frozen sections. By inking the margins of each piece the separate pieces can be mapped together. The surgeon constructs a map (figure 2).

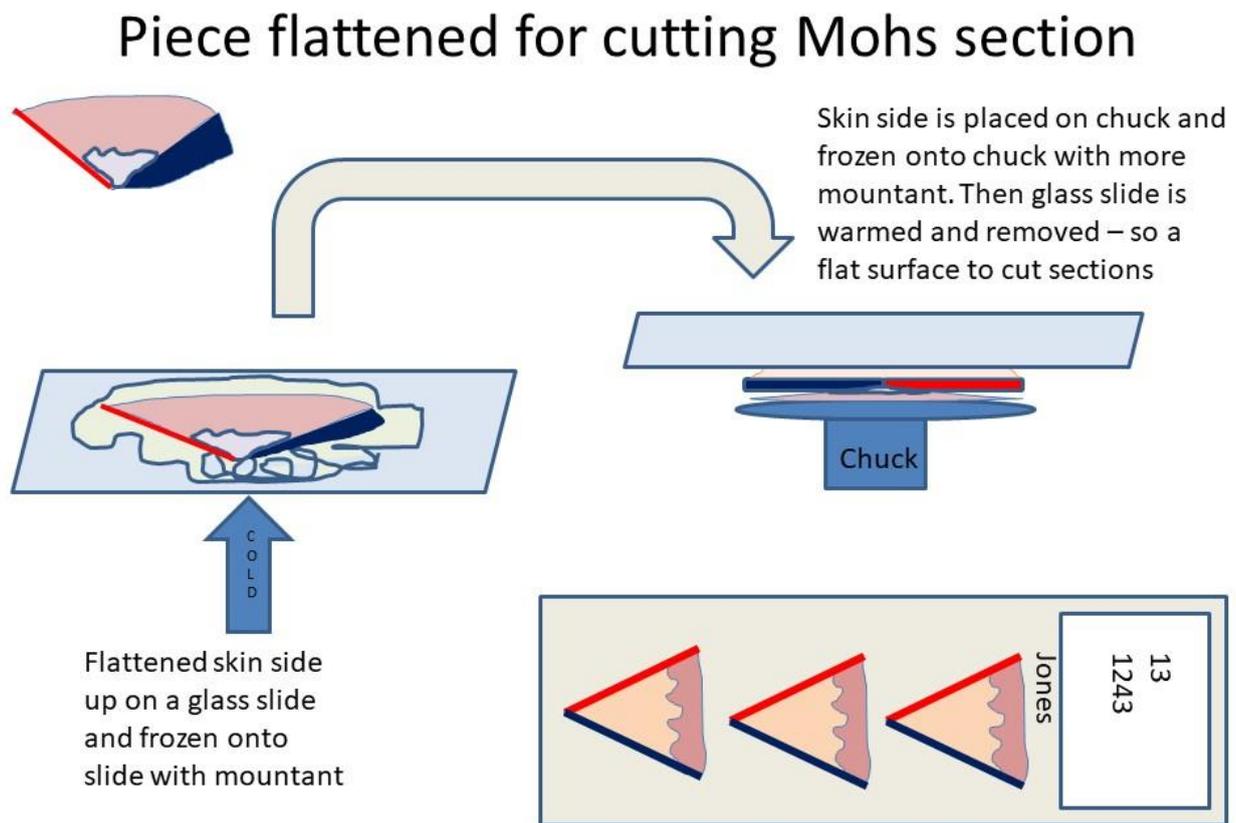
Figure 2: Mohs map. The red and black lines correlate to the ink the surgeon puts onto the specimen. In this case tumour was present around the 6 O'clock area and so a further level was taken. The thinner lines running across the pieces are how the specimen was cut after formalin fixation.



The pieces are flattened on the cryostat with the outer surface uppermost (figure 3). Frozen sections are then cut and stained with toluidine blue and standard H&E. These are often triangular and will have epidermis along one edge and then ink on the other two edges. It is essential that the sections

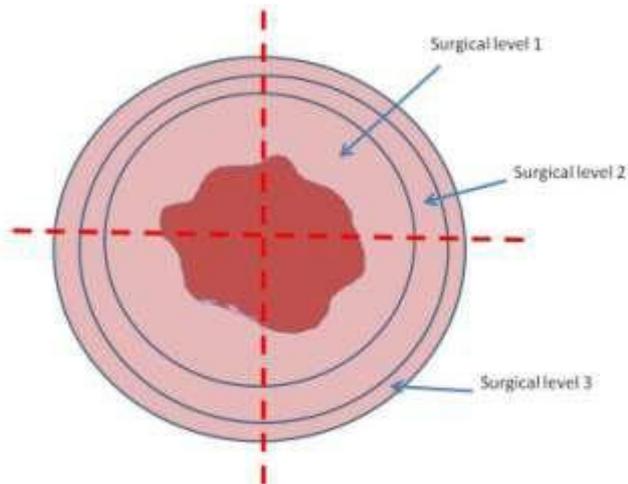
have an uninterrupted epidermis contiguous with uninterrupted inked edges all the way around the periphery and no holes in the section in between. Not all the sections may have this but as long as sections over several levels demonstrate this that is often sufficient.

Figure 3 Specimens are flattened on cryostat chuck with surgical margin on top.



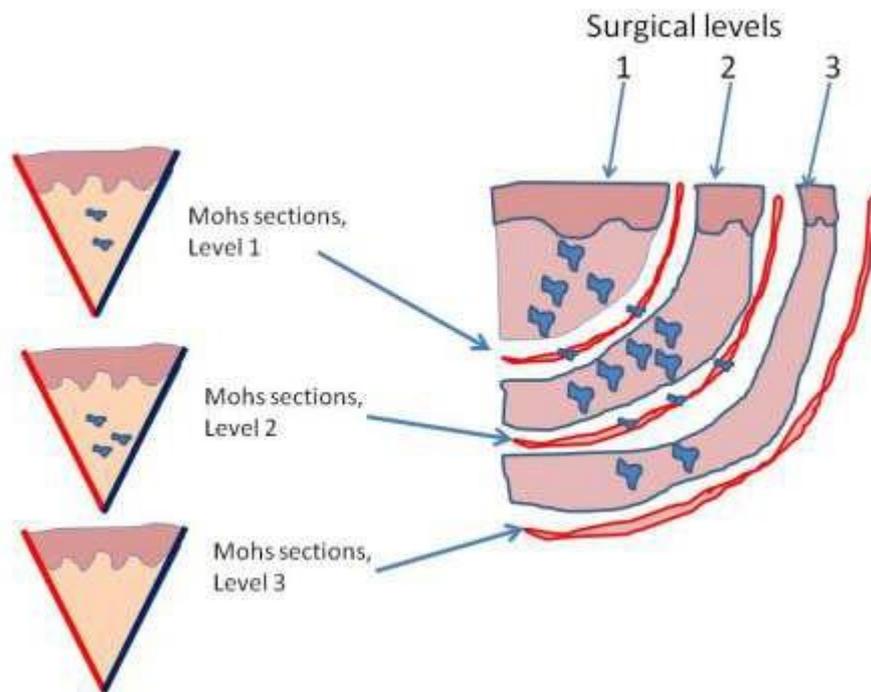
If tumour is present in the sections the surgeon will go back to that particular area and take another sliver of tissue. This is the importance of the map as not necessarily all the pieces will be involved. If another shave is taken this is called level 2 (Figure 4). The frozen section procedure is then repeated and if this is positive for tumour then level 3 is taken etc. This is not to be confused with levels cut through the same piece of tissue.

Figure 4 Surgical levels.



When the margins are deemed clear the samples are transferred from the microtome chucks to formalin. Following fixation the pieces are cut perpendicular to the inked margins – so yielding several pieces per frozen specimen. These are referred to as cryoparaffin sections. These are curved with epidermis at the top side edge and ink at opposite edge. Where the frozen section was taken from is at the bottom side and at the top side the upper level or curettage was taken from (figure 5 and 10).

Figure 5: Relationship of frozen sections to cryoparaffin sections



What does the pathologist report?

The pathologist needs to review the frozen sections (Mohs sections). The surgeon will have reported these but if there is a discrepancy then this should be noted. The surgeon marks the map with a dot where the tumour is seen.

The toluidine blue stain is used for the Mohs sections as it gives pink stromal metachromasia around a basal cell carcinoma (Figure 6). This might be diminished or absent in infiltrative basal cell carcinomas. Pink staining is also seen around hair follicle structures (Figure 7) and light staining may be present in nerves and vessel walls (Figure 8). Pink staining associated with inflammatory cells may indicate the periphery of tumour that may appear in the adjacent Mohs sections.

Figure 6: Toluidine blue stain of a Mohs section showing tumour stroma highlighted by pink staining.

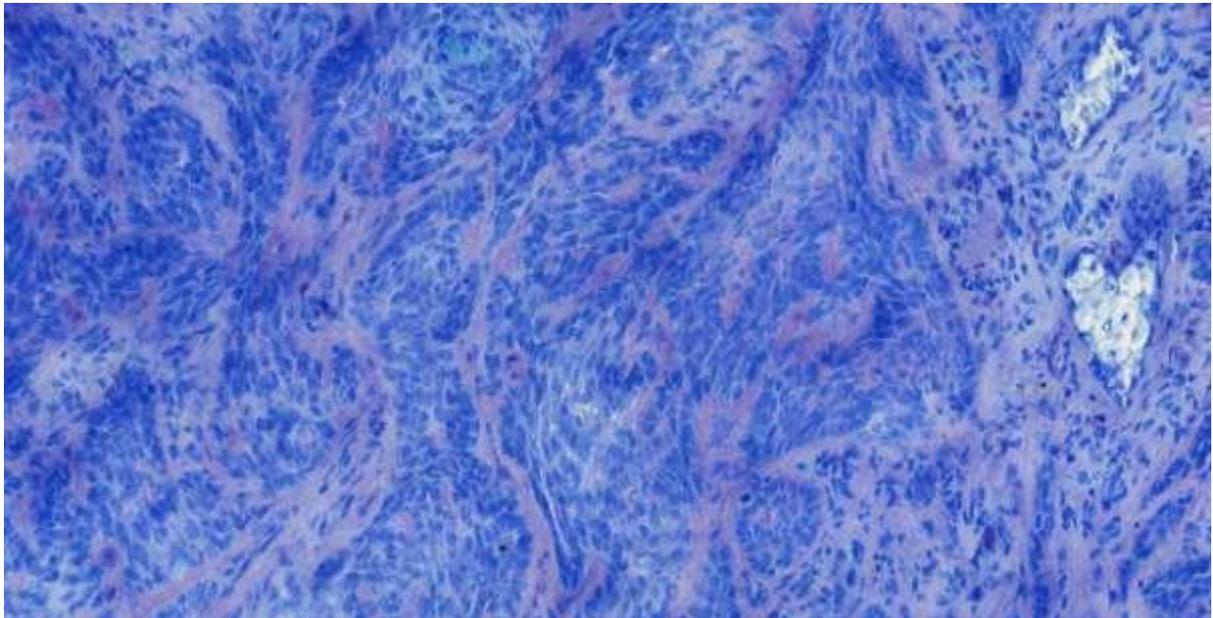


Figure 7: Toluidine blue stain of Mohs section shows pink staining around a normal adnexal structure.

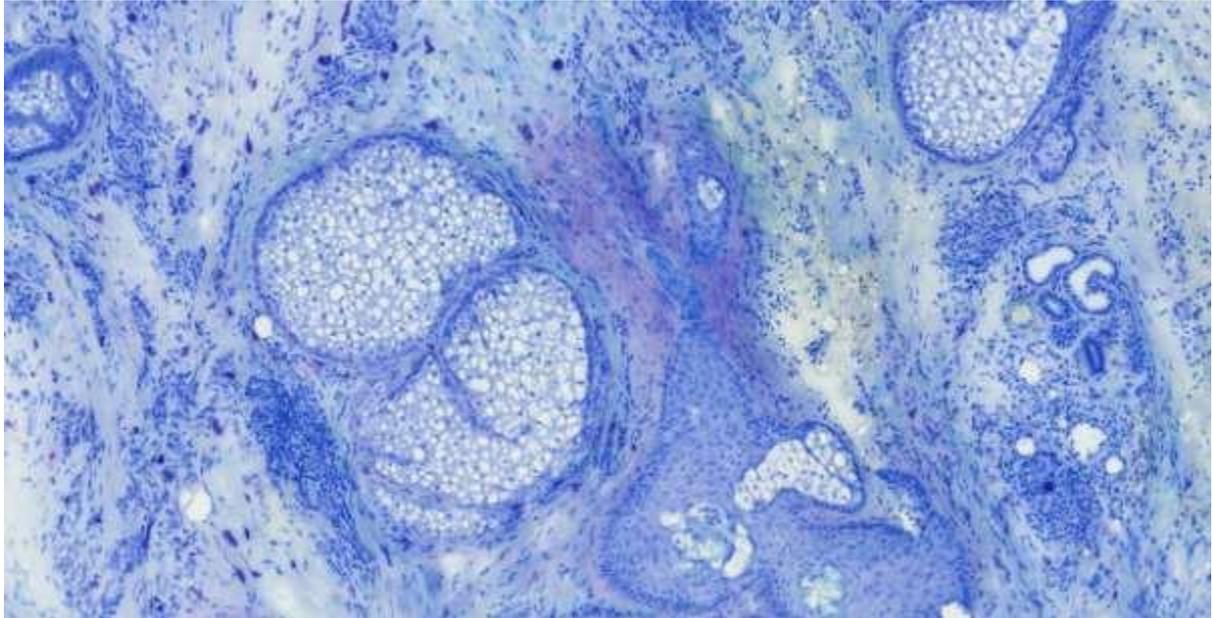
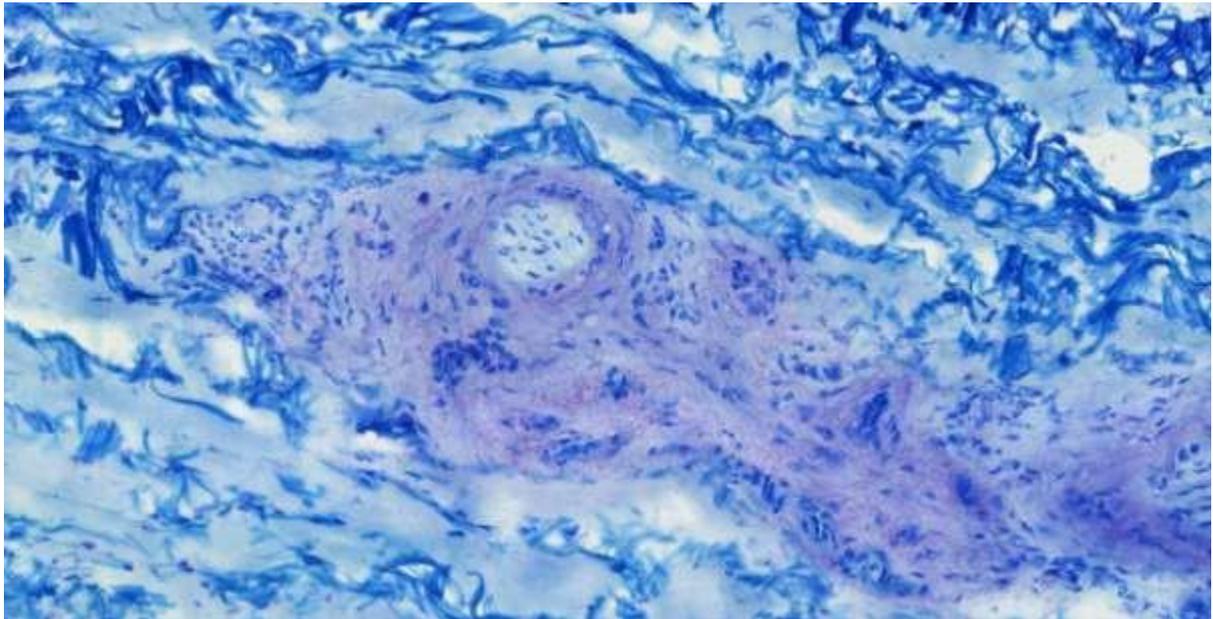


Figure 8: Toluidine blue showing perineural invasion



Most pathologists are used to reporting the H&E and these are no different, and tumour can be recognized.

Figure 9a Low power of Mohs section

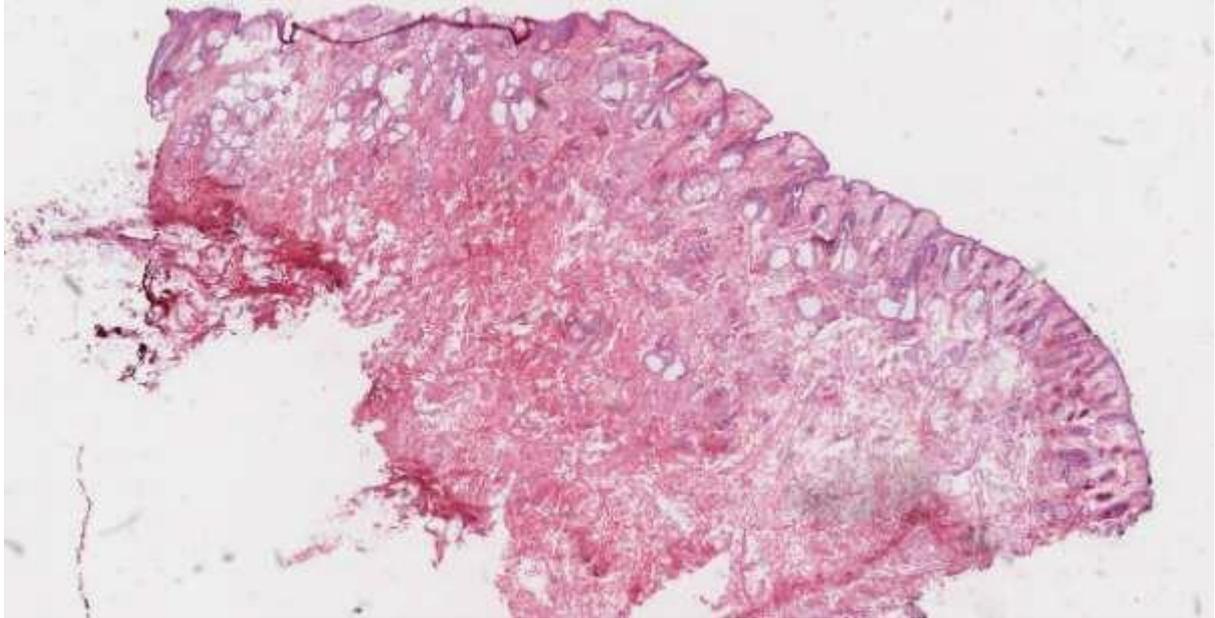
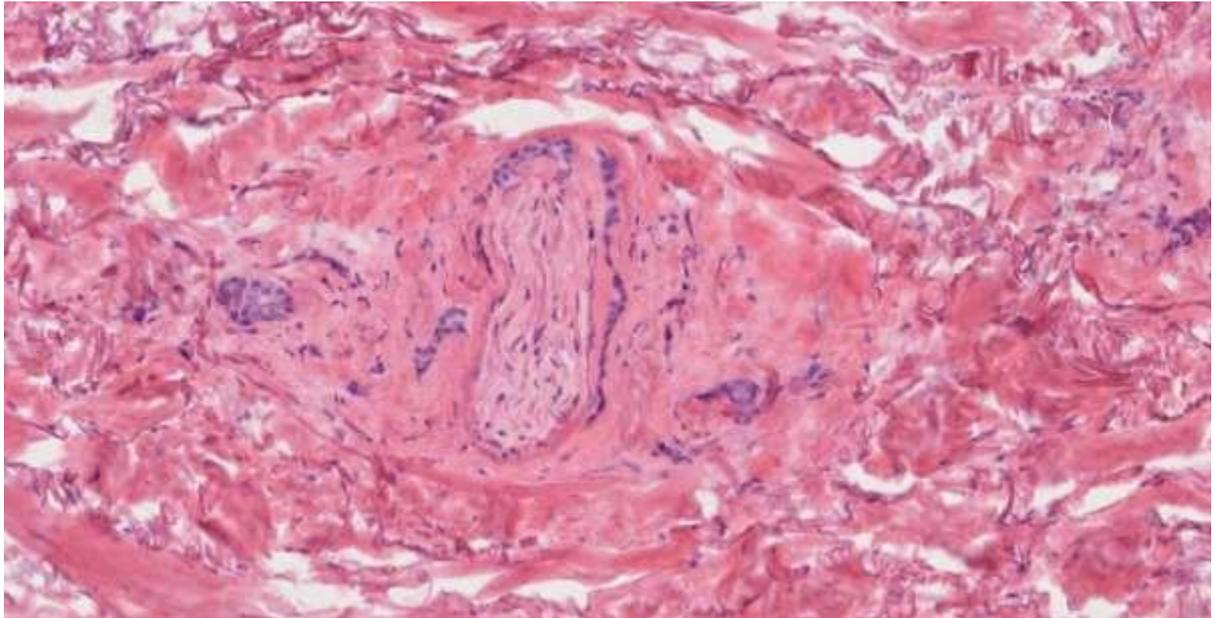


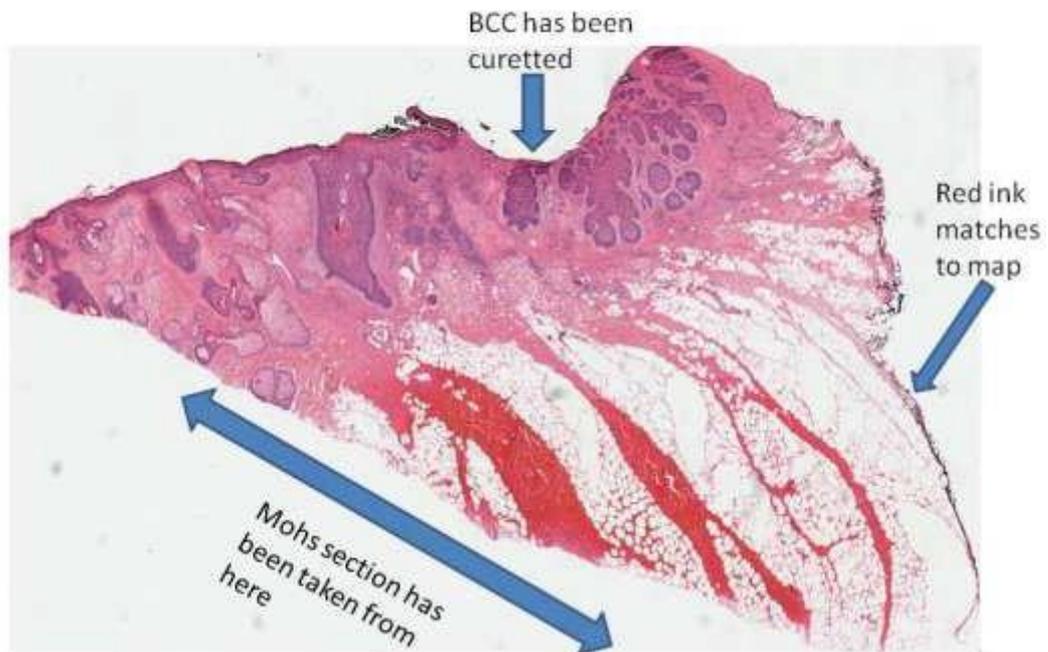
Figure 9b Higher power of Mohs section showing perineural invasion.



The cryoparaffin sections are taken perpendicular to Mohs sections (figure 5 and 10)

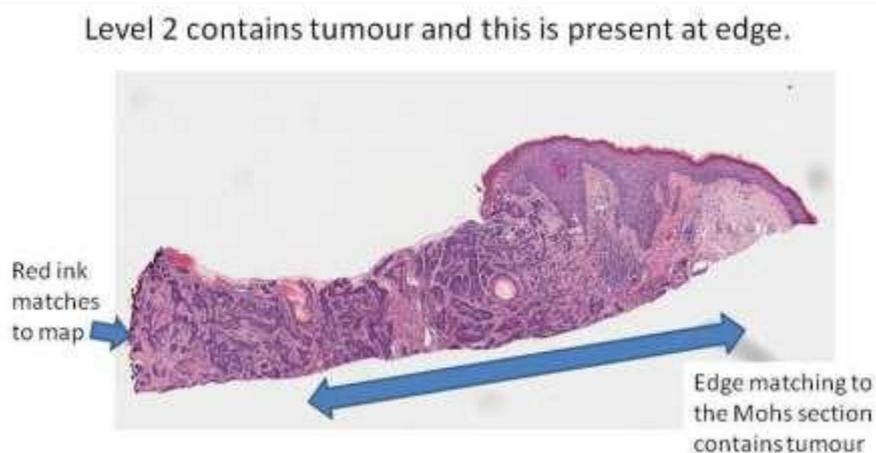
Figure 10: The cryoparaffin sections appear as semi-circular sections.

Cryoparaffin section



The pathologist needs to comment on whether there is tumour present and if it is close or at the edge where the Mohs section was taken. It must be remembered that if tumour is at the edge then the Mohs section is likely to be positive but if the Mohs section is negative then this is actually a negative margin.

Figure 11: Cryoparaffin section with involved edge.



Acknowledgements

I am grateful to Dr Adam Bray, Consultant Dermatologist, Bristol, for reviewing this document.

Reporting proforma

In order to capture as much data as possible a proforma can be used:

Site:

Curettage:

Not sent (*delete if specimen*)

Diagnosis: *basal cell carcinoma, squamous cell carcinoma, no tumour*

Perineural invasion: Yes/No

{If BCC otherwise delete}

Subtype:

Atypical squamous component present: Yes/No

If SCC

Differentiation:

Mohs margins

Intraoperative report:

Section A: *if tumour which level*

Section B:

Section C:

Section D:

Add more if necessary

Reported by : *Mohs surgeon*

Review

Section A: *if tumour which level*

Section B:

Section C:

Section D:

Add more if necessary

Cryoparaffin sections

Section A: Tumour present/absent and present/distant (>1mm)/close to edge (<1mm)

Section B:

Section C:

Section D:

Add more/delete if necessary

Overall Conclusion:

Type of tumour:

No tumour present *Delete if necessary*

Perineural invasion: Yes/No

If Mohs review agrees with intraoperative report then state

The Moh's margins are confirmed to be tumour free in the planes of sectioning of the levels of excision.

If Mohs review disagrees with intraoperative report then state

Clinical correlation is required to confirm adequacy of excision

Example of report:

Example 1

Site: Right side of forehead

Curetting:

Diagnosis: basal cell carcinoma

Perineural invasion: No

Subtype: Infiltrative

Atypical squamous component present: No

Mohs margins

Intraoperative report: All negative

Section A: Negative

Section B: Negative

Section C: Negative

Section D: Negative

Reported by : Dr xxx

Review

Section A: Negative

Section B: Negative

Section C: Negative

Section D: Negative

Cryoparaffin sections

Section A: Tumour, distant from edge

Section B: No tumour

Section C: Tumour, distant from edge

Section D: Tumour, distant from edge

Overall Conclusion:

Type of tumour: Infiltrative Basal cell carcinoma

No perineural invasion

The Moh's margins are confirmed to be tumour free in the planes of sectioning of the levels of excision.

Example 2:

Site: left eye

Curetting:

Diagnosis: basal cell carcinoma

Perineural invasion: No

Subtype: Nodular and infiltrative

Atypical squamous component present: No

Mohs margins

Intraoperative report:

Section A: Negative

Section B: Tumour - Clear in 2nd layer G

Section C: Negative

Section D: Tumour - Clear in 2nd layer H

Section E: Negative

Section F: Negative
Section G: Negative
Section H: Negative

Reported by : Dr xxxx

Review

Section A: Negative
Section B: Tumour - Clear in 2nd layer G
Section C: Negative
Section D: Tumour - Clear in 2nd layer H
Section E: Negative
Section F: Negative
Section G: Negative
Section H: Negative

Cryoparaffin sections

Section A: Tumour, distant from edge
Section B: Tumour, at the edge
Section C: Tumour, distant from edge
Section D: Tumour, at the edge
Section E: Tumour, distant from edge
Section F: Tumour, distant from edge
Section G: Negative
Section H: Negative

Overall Conclusion:

Type of tumour: Infiltrative Basal cell carcinoma
No perineural invasion

The Moh's margins are confirmed to be tumour free in the planes of sectioning of the levels of excision.