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What I tell my patients about Mohs micrographic surgery

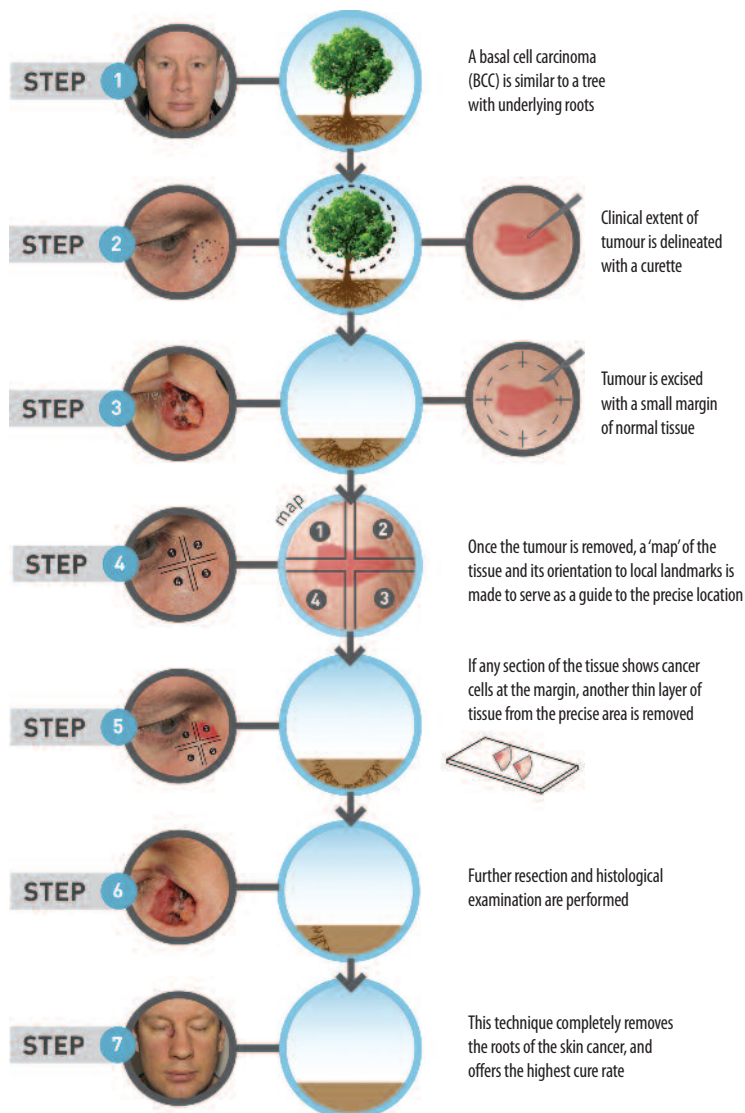
Mohs micrographic surgery is a highly specialised, state-of-the-art technique used for the treatment of complex skin cancers. It is named after Dr Frederick Mohs, who developed the procedure in the 1930s, when he was a medical student at the University of Wisconsin, USA.

Mohs micrographic surgery is different from routine surgical excision, since the removed tissue is carefully mapped, colour-coded and examined microscopically by the dermatologist on the day of surgery. During this process, all tissue margins are thoroughly evaluated to ensure that the

tumour has been completely removed before the skin defect is repaired (see Figure 1). For this reason, Mohs micrographic surgery results in the highest cure rate for complex skin cancers while minimising the removal of normal tissue (see Box 1).

Standard surgical excision allows the delayed examination of approximately 1% of tissue margins. As only a small percentage of margins are evaluated, residual tumour may be missed (see Figure 2). If more cancerous cells are found during the delayed pathological examination, a second surgical procedure will be needed at a later date.

■ **Figure 1.**
Schematic of
Mohs micrographic
surgery technique



Box 1. Advantages of Mohs micrographic surgery

- Highest cure rate for skin cancer
- Smallest amount of normal skin is removed, maximising the likelihood of preserving function and minimising scarring
- Fewer risks from anaesthesia, as no need for general anaesthetic (local anaesthetic is enough)

Box 2. Indications for Mohs micrographic surgery

- The tumour is in a high-risk site
- The tumour has recurred or was incompletely excised
- The tumour is larger than 2 cm
- The tumour is poorly defined
- The tumour has grown in an area previously treated with radiotherapy

Mohs surgeons are dermatologists who have undergone additional fellowship training to become experts in Mohs micrographic surgery. They are highly skilled in all aspects of the technique, including surgical removal of the tumour, pathological examination of the tissue and advanced reconstruction of the skin. Referral for Mohs micrographic surgery will usually be made by your dermatologist, after a biopsy has been taken to confirm your diagnosis of skin cancer.

Indications

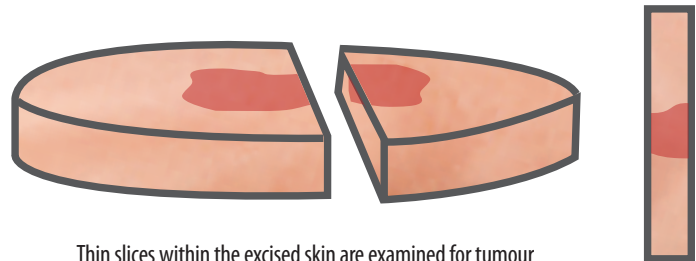
Indications for Mohs micrographic surgery are listed in Box 2. Most tumours treated with Mohs surgery are complex basal or squamous cell carcinomas, the most common one being basal cell carcinoma. In some circumstances, Mohs surgery can be used to treat less common tumours, such as sebaceous gland carcinoma, microcystic adnexal carcinoma or dermatofibrosarcoma protuberans.

Skin cancers are classified as complex when they fulfil one or more of the following criteria:

- The cancer is in an area where the preservation of healthy tissue is critical to maintain function and cosmetic appearance (for example, the eyelids, nose, ears or lips)
- The cancer is in an area of high tumour recurrence (for example, the ears, lips, nose, eyelids or temples)
- The cancer was incompletely treated, or was previously treated and has recurred
- The cancer is large
- The edges of the cancer cannot be clearly defined.
- The cancer grows in an area previously treated with radiation therapy

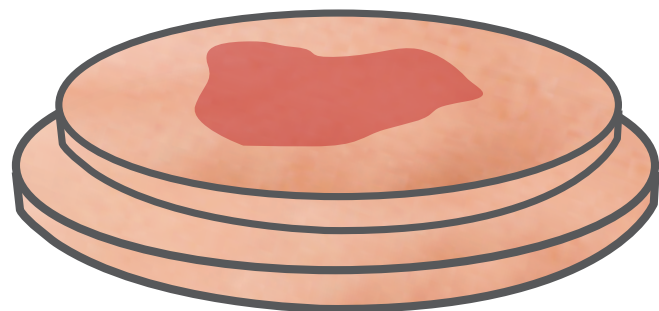
Schematic representation of a pathological examination of tissue margins

Representative sample of tissue examined by traditional 'bread loaf' pathological examination



Thin slices within the excised skin are examined for tumour
Only 1% of the surgical margin is examined by this technique

100% peripheral margin examined by Mohs micrographic surgery



The entire (100%) surgical margin is examined for tumour

■ **Figure 2.** Pathological examination of tissue margins with standard surgical excision (top) and with Mohs micrographic surgery (bottom)

- The patient is immunosuppressed (for example, after an organ transplant)
- The patient is prone to developing multiple skin cancers (for example, they have genetic syndromes such as basal cell naevus syndrome and xeroderma pigmentosa).

The procedure

The Mohs surgical procedure involves a series of repeated excisions followed by microscopic examination of the tissue to assess whether any tumour cells remain (see Figure 1). Tumours that appear small during clinical examination may have extensively invaded the skin underneath and therefore result in a larger surgical defect than would be expected. Predicting the final size of the wound is therefore impossible until the surgery is

completed. As Mohs micrographic surgery is used to treat complex skin cancers, approximately half of all treated tumours require two or more excision stages to achieve complete excision.

To explain the procedure we commonly use the analogy of an oak tree growing on a pristine lawn with extensive roots underground. The visible part of the cancer is the tree's trunk and branches, and the invisible part is the tree's underlying roots. If the roots of a tree are not completely removed, the tree can grow back. Similarly, if the roots of the skin cancer are not completely removed, the skin cancer can return. The Mohs technique ensures that all the roots are completely removed, making a return of the cancer far less likely. Figure 1 illustrates the technique and is described in more detail below.

Step 1: Anaesthesia

The tumour site is injected with a local anaesthetic to completely numb the tissue and surrounding area. A general anaesthetic is not required for Mohs micrographic surgery.

Step 2: Removal of the visible tumour

Once the skin tissue and surrounding area have been completely numbed, the tumour is gently scraped with a curette (a semi-sharp, scoop-shaped instrument). Sometimes a scalpel is used instead. This helps to define the clinical margin between tumour cells and healthy tissue.

Step 3: Removing the first layer of tissue

The first thin, saucer-shaped layer of tissue is then surgically removed by the Mohs surgeon. A device

called a hyfrecator, which transmits a small electric current, will be used to stop any bleeding.

Step 4: Mapping the tumour

Once the first layer has been removed, a 'map' or drawing of the tissue and its orientation in relation to local landmarks (for example, the nose or cheek) is made to serve as a guide to its precise location. The tissue is labelled and colour-coded to correlate with its position on the map. The tissue sections are processed by a laboratory technician and then examined by the Mohs surgeon, who thoroughly looks for evidence of remaining cancer cells. It takes approximately 60 minutes to process, stain and examine a tissue section. During this time, your wound will be bandaged and you will return to the waiting area.

Step 5: Taking further layers if needed

If any section of the tissue shows cancer cells at its margin, the surgeon returns to that specific area of the tumour, as indicated by the map, and removes another thin layer of tissue – but only from that precise area where remaining cancer cells have been detected.

Step 6: Ensuring all the cancer cells are removed

The newly excised tissue is again mapped, colour-coded, processed and examined for further cancer cells. If microscopic analysis still shows evidence of disease, the process continues layer by layer until the cancer has been completely removed.

This selective removal of the tumour allows the Mohs surgeon to preserve most of the surrounding normal tissue. Because this systematic microscopic search reveals the roots of the skin cancer, Mohs surgery offers the highest chance of complete removal of the cancer while sparing normal tissue. Cure rates typically exceed 99% for new cancers and 95% for recurrent cancers.

Step 7: Reconstruction

Mohs surgeons are experts in the reconstruction of skin defects. Reconstruction is tailored to the individual in order to preserve normal function and maximise aesthetic outcomes.

The most effective method of repairing the wound following surgery is determined only after the cancer has been completely removed, as the size of the final defect cannot be predicted beforehand. Stitches may be used to close the wound from side to side, or a skin graft or flap may be designed. Sometimes a wound may be allowed to heal naturally. In certain circumstances, you may be referred to a plastic, oculoplastic, or ear, nose and throat surgeon for the reconstruction ■

Key points

- Mohs micrographic surgery is a highly specialised technique used in the treatment of complex skin cancers. It involves careful excision, mapping, colour-coding and examination of layers of tissue until all the cancer cells have been removed.
- Mohs surgeons are skilled in all aspects of the technique, including surgical removal of the tumour, pathological examination of the tissue and advanced skin reconstruction.
- The majority of tumours treated with Mohs micrographic surgery are complex basal or squamous cell carcinomas, basal cell carcinomas being the most common.
- Mohs micrographic surgery results in the highest cure rate for complex skin cancers while sparing normal tissue.