

Mohs Micrographic Surgery

Mohs Surgery combines surgical excision under local anesthesia with immediate microscopic examination of the entire tissue specimen margin by frozen tissue processing techniques, while the patient waits for the results. Dr. Joanna Chan serves as the Mohs surgeon and pathologist, examining 100% of the tissue margin to ensure clearance of the cancer and the highest cure rate, while minimizing the sacrifice of normal skin. **Plan to be here for 2-4 hours.**

On the day of arrival, the front desk will check you in, and Dr. Chan's assistant will escort you to a room. You will be asked to confirm the site for surgery and to sign a consent form, giving us permission to proceed with the surgery. Dr. Chan will answer any questions you have prior to surgery, and your skin cancer will be photographed to document the process.

1. The skin is cleansed and numbed with a local anesthetic. The area is marked to create a map, followed by surgical removal of a thin layer of skin (1-2 mm margin around biopsy site), containing the tumor in the shape of a pie.
2. The pie-like specimen is divided into slices that are mapped and color-coded onto a paper map in the same orientation that corresponds to the patient's skin.
3. Our laboratory staff freezes the tissue, sections into tissue paper thin slices that are placed onto glass slides and stained in our Mohs lab. The tissue is oriented onto the slide, so that the border of the tissue or the "pie crust" is examined.
4. The slides are examined by your Mohs Surgeon to determine if any tumor cells are left behind. If the tumor is removed completely, the skin defect is ready to be repaired. If the specimen has residual tumor, steps 1 through 4 are repeated until the skin is clear of tumor (see diagram).

The Mohs Micrographic Surgery technique differs from standard excision in that less normal tissue is removed initially (1-2 mm margin), and 100% of the tissue edge is processed to control the margin microscopically using an iterative technique. By reducing the amount of normal skin removed, this minimizes size of the defect, making it easier to repair the defect, thus resulting in a smaller scar. Reconstruction usually occurs immediately after removal.

Standard excision usually requires 4-5 mm margins, and the tissue is processed using sections cut up and down like a bread-loaf, such that the pathologist only examines 1% of the margin. Even with "clear margins" as assessed by the pathologist, the curative rate with standard excision is 94-95% (approximately 1 in 20 will recur) compared to 99.9% cure with Mohs Micrographic Surgery.

Mohs surgery is indicated for recurrent skin cancers, tumors of the head/face & neck, large and ill-defined tumors off the face, aggressive pathology (micronodular, infiltrative, morpheaform tumors), areas of prior radiation, immune compromised patients (e.g., lymphoma patients), and cancers occurring in areas with limited tissue mobility (e.g, hands, shins).

Because the tissue is processed in the lab, and multiple stages may be required to clear the tumor, patients are advised that the procedure may last 2-4 hours, and in rare instances longer. We advise patients to eat a good breakfast or lunch prior to the procedure, and to bring reading material or something to occupy their time while waiting for results. Once the margins are clear of cancerous cells, the resulting defect is usually repaired on the same day. If a full-thickness skin graft is required, then cosmetic results are generally improved by waiting 1-2 weeks to heal by nature, prior to placing sutures to close the wound. Larger tumors may require more time or reconstruction on a subsequent day.

How To Prepare For Your Surgery

1. Do not take any blood thinners prior to surgery. Stop Aspirin or Aspirin-containing products for at least 2 weeks prior to your surgery. The most common blood thinners are fish oil, vitamin E, ibuprofen or other anti-inflammatory medications (NSAID's). **Please see blood-thinner entire list.** Stop Aspirin, Plavix, and Coumadin only if your Cardiologist approves. Please do **stop aspirin at least 10 days ahead,** if you are only taking it as a preventative measure.
2. If you need to take antibiotic prophylaxis before surgery or dental procedures, take your first dose 1 hour before coming to the office for your Mohs surgery. If you do not have a prescription at home, please notify us at least 3 days in advance of your surgery date, so that a pharmacy can be called. We recommend antibiotic prophylaxis for any tumors near mucosal surfaces (lips, genitals, nose), eyes, ears, scalp, hands or lower extremities, as these are prone to infection.
3. If your skin cancer is located in the center of your face, eyelid, or eyebrow area where a bandage will block your vision or impact your ability to wear glasses, please have someone available to drive you to and from the office.
4. Eat a normal breakfast or lunch on the day of surgery. If you wish to bring your own lunch or snacks, we have refrigerator space available for you.
5. **Please wear comfortable clothing that you do not mind getting dirty.** Avoid wearing white, silk, or difficult to wash items. Bring a sweater or jacket, in case you tend to feel chilly while waiting. Make sure that your shirt can easily be removed without disturbing a bulky pressure bandage. Clothing that buttons in front, has a large neck opening or is loose fitting is preferred. Do not wear one-piece outfits, if the cancer is on your upper body.
6. Please take a shower and wash your hair on the morning of the day of surgery. **You will not be able to shower for 24 hours following surgery.** Do not apply makeup (if the skin cancer is on your face), perfume, aftershave, or cologne. **Shave any hairy areas around the tumor.** If hair will cover the tumor, please consider bringing your own hair accessories (headband, bobby pins, clips).
7. Take all of your routine medications, *ESPECIALLY take your blood pressure medications* as you normally would EXCEPT any of your medications that we have told you to stop (see blood-thinner list).
8. If you are unable to keep the scheduled appointment for surgery, please contact our office **at least 48 hours in advance** to reschedule your surgery appointment. This allows us to schedule other patients waiting to take your slot, as we pre-pay the technician's fees for your slot. You may be charged a fee for the technician, if we cannot reschedule your appointment with another patient.
9. If you need a narcotic medication following surgery, please inform the doctor on the day of the procedure. Most patients do very well with icing and Tylenol over the counter. **Avoid aspirin and ibuprofen / NSAIDs for 3 days following the procedure to reduce bruising / bleeding risk.**
10. If you are claustrophobic, needle-phobic or extremely anxious, you may consider taking sedative medication (Ativan / Valium) prior to the procedure. **Please schedule a pre-operative Mohs consultation** appointment to pick up a prescription, which you will take only after consent forms are signed. You will need to bring a driver on the day of surgery or be dropped off / picked up.
11. Please arrive 15 minutes early to be roomed, sign consent forms, confirm the biopsy site, and ask questions. You are welcome to bring a friend or loved one, and please bring reading material or something to do while waiting.

Activity Level Following Surgery

Aim to spend the first day following surgery relaxing and recovering from surgery. Do not elevate your blood pressure for 48 hours. Expect the area around the surgical site to bruise, which can last 1-2 weeks. Keep the area elevated (sleep on a few pillows if tumor is on the head). Ice the area using frozen peas or ice packs for 5-10 minutes each hour while awake for the first 1-2 days to minimize pain, swelling, and bruising. Surgery on the forehead, cheek, or eyelid may result in black eye(s) that can last about a week. If the surgery was on the lower leg, we recommend wearing compression stockings immediately after surgery, which can be prescribed if you do not own any. Heavy lifting and exercise are not allowed until after the sutures are removed. You can shower 24 hours after surgery. Swimming is not allowed until after the sutures are removed.

Please refer to the following handouts for more information:

- 1) Diagram: The Mohs Surgery Process (see below)
- 2) Reconstruction
- 3) Frequently Asked Questions
- 4) Blood Thinners to Avoid
- 5) Wound Care Instructions

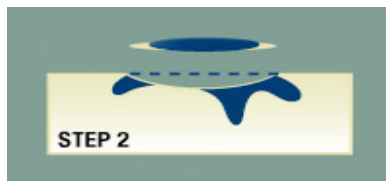
Diagram: The Mohs surgery process

Step 1



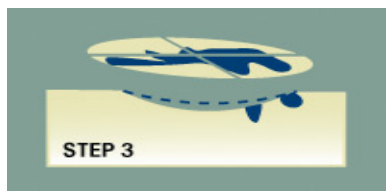
The roots of a skin cancer often extend beyond the visible portion of the tumor. If these roots are not removed, the cancer will recur. Dr. Chan will first examine the visible lesion and circle the area with a surgical marker. The area will then be numbed with local anesthesia, and the surgery will begin.

Step 2



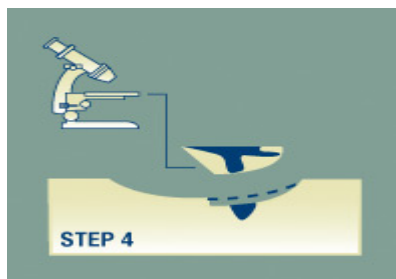
Dr. Chan will remove the visible portion of the tumor with a small margin of normal tissue. The goal is to minimize the normal tissue that is sacrificed in the process of removing the cancer.

Step 3



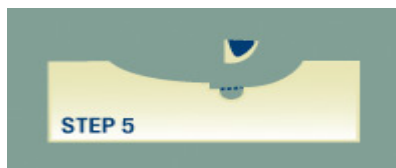
Dr. Chan will divide and “map” the tissue using reference marks he makes in the skin, and color-code the tissue. She will draw a corresponding map of your skin. The technician will then process your tissue and put it onto slides, so that Dr. Chan can check it under the microscope.

Step 4



In the laboratory, Dr. Chan uses a microscope to examine the undersurface and edges of each section of tissue in search of evidence of remaining cancer. This is an extremely meticulous process requiring visualizing that every last tumor cell has been removed, and that 100% of the skin edge is checked for a clear margin.

Step 5



If Dr. Chan finds cancer cells under the microscope, she will mark their location on the map and return to remove another layer of skin, but only from precisely where the cancer cells originated. This method ensures that the Mohs surgery results in the smallest defect possible.

Step 6

The removal process stops when there is no longer any evidence of cancer in the surgical site. Because Mohs surgery removes only tissue containing cancer, it ensures that the maximum amount of healthy tissue is kept intact. At this point, Dr. Chan will discuss reconstructive options then repair your surgical wound. Before you leave for the day, one of her assistants will carefully go over wound care instructions, and answer any questions that you may have.

Reconstruction

While treatment of your skin cancer is the primary concern, reconstruction of the treated area is also important. After Dr. Chan is confident that all of the cancer has been removed, together you will determine how the wound will be repaired. In the majority of cases, Dr. Chan will repair your wound on the same day as your Mohs procedure. In addition to removing skin cancer, fellowship trained Mohs College surgeons have specialized reconstructive surgery training utilizing plastic surgery techniques for repairing the wound. Dr. Chan has performed thousands of Mohs surgeries and reconstructions.

Depending on the size of the tumor, depth of roots, and location, one of the following options will be selected:

- **Primary (side-to-side) closure:** Closing the wound with sutures (stitches) is often performed on small wounds. This involves sewing the skin edges together from side-to-side. The wound will typically need to be elongated into a “football” shape so that the ends don’t pucker when the wound is sewn together, and the scar heals in a straight line. This procedure can provide an excellent cosmetic result when the scar can be hidden in a wrinkle line. Sutures are typically removed 1 week after surgery.
- **Spontaneous granulation or second intention healing (mother nature):** This type of healing allows the body to heal the wound on its own, without sutures. Certain areas of the body will naturally heal very nicely, so there is no need for a reconstructive surgical procedure. This process can take 6-8 weeks with daily bandage changes.
- **Skin flaps:** Skin flaps involve movement of nearby or adjacent healthy tissue similar in texture, consistency and color to cover a surgical wound. Skin flaps are often chosen because of the excellent match of nearby skin. Skin flaps are sutured closed, and your sutures will need to be removed in approximately 1 week after surgery. The broken up lines are generally difficult to find after the healing process is complete (6-12 months).
- **Skin grafts:** Skin grafts involve taking a piece of healthy skin from another part of the body to replace the skin that was removed, like patching a tire. These wounds are also sutured, This dressing is removed 7-10 days after surgery.
- **Consultation with a Facial-Plastic or Oculoplastic Surgeon who specializes in complicated surgical repairs.** Occasionally, it may be necessary to enlist the help of another surgeon to perform your surgical reconstruction. This is usually because a wound is very large, and it may be necessary to have the closure performed in an operating room under general anesthesia or twilight sleep. If your skin cancer involves a large portion of your eyelid, or if your tear duct is involved, it may be necessary to have an oculoplastic surgeon perform your reconstructive surgery. If you have been referred to our office by a physician skilled in skin closures (for example a plastic or oculoplastic surgeon), he or she may perform the final reconstruction after your skin cancer has been completely removed by Mohs surgery. We need to coordinate with that office prior to scheduling Mohs, so that reconstruction can be scheduled soon after Mohs surgery.

Post-Operative care

One of Dr. Chan’s assistants will provide detailed wound-care instructions after your surgery has been completed. These instructions will also be provided in writing. You may be given antibiotics or pain medication after surgery, and it is important to take these medications as directed, with food and avoiding driving if taking narcotics.

Frequently asked questions

Why is it called Mohs surgery? Is Mohs an acronym? The term "Mohs" refers to Dr. Frederic Mohs, Professor of Surgery at the University of Wisconsin, who developed this surgical technique in the 1930s. The technique has undergone many refinements and has come to be known as "Mohs micrographic surgery" or simply "Mohs surgery" in honor of Dr. Mohs.

Will I be awake during surgery? What if I get anxious? Mohs surgery is performed at Dr. Chan's office under local anesthesia, so you will be awake during the procedure. The use of local anesthesia versus general anesthesia provides numerous benefits, including preventing a lengthy recovery and possible side effects from general anesthesia. You are completely numb in the area of the surgery, though, so the procedure is comfortable. **If you think you might be anxious the day of surgery, let Dr. Chan or the office staff know in advance, and she will be happy to prescribe a mild sedative to help you feel more relaxed the day of surgery. You must sign consent BEFORE taking these medications.**

Do I need to stop taking any of my medications prior to surgery? What about blood thinners? If you are taking a blood thinning medication such as **aspirin, Plavix, Aggrenox or Coumadin** (warfarin) because you have had a stroke, artificial heart valve, blood clot or heart attack, **you should remain on it for the surgery.** While this may increase minor bleeding during the procedure and bruising afterward, it is less dangerous than having another stroke, heart attack, or blood clot.

If you take one of these medications for preventative reasons, check with your primary care physician to see if it is safe to stop them before surgery (10 days prior). **Do not stop them without checking with your doctor.**

The following vitamins and supplements can increase risk of intra- and post-operative bleeding. If you take any of these supplements, please discontinue them 2 weeks prior to surgery and for 1 week thereafter: **Vitamin E, ginko, garlic, ginseng, fish oil.** **Please refer to the blood-thinner list.** We recommend that you use acetaminophen (Tylenol) for post-operative pain, rather than taking aspirin, ibuprofen, naproxen or other NSAIDs, because these can increase bleeding risk.

I don't see anything after my biopsy. Do I really need to be treated?

Yes. While your skin cancer may no longer be visible after your biopsy, the surface lesion that was removed can represent the "tip of the iceberg." More tumor cells usually remain in the skin. These can continue to grow downward and outward, like roots of a weed that will eventually grow back. These "roots" are not visible with the naked eye. If they are not removed, the tumor will likely reappear and require more extensive surgery.

Tumors that are neglected can spread deeply into the skin and invade nearby structures. On rare occasions, these cancerous cells can metastasize to lymph nodes and other organs in the body.

How long does Mohs surgery take?

It is impossible to tell in advance how long Mohs surgery will take, because we cannot predict how many stages it will take to clear your skin cancer. Large and complex wounds may take more time to reconstruct. Please expect to spend at least 2-4 hours, or possibly the entire day at our office, but the average only a few hours. Inform us upon your arrival if you have any other important appointments that day.

Will I have pain after surgery?

Most patients have only minimal pain after surgery, which can typically be managed with icing and taking extra-strength Tylenol (acetaminophen). You can take up to 4,000 mg (or 8 extra-strength tablets) each day, if you have no liver problems. Please avoid taking ibuprofen or aspirin for pain, as these medications can increase bleeding risk. If Dr. Chan suspects that you will have more severe pain after surgery, she will give you a prescription for a stronger pain medication. If you are concerned about post-operative pain, please let Dr. Chan know before leaving the office as a narcotic script must be hand-carried to the pharmacy.

Will Mohs surgery leave a scar?

Yes. As will any treatment for skin cancer, Mohs surgery will leave a scar. Mohs surgery preserves as much healthy skin as possible and maximizes options for repairing the surgical defect, once the tumor is completely removed. Once Dr. Chan has completely removed your skin cancer, reconstruction for optimizing the final functional and cosmetic result becomes the highest priority. Generally, a post-surgical scar improves with time and can take up to 1 year to fully mature. As your surgical site heals, new blood vessels can appear and support the healing changes occurring underneath the skin, causing a reddish appearance of the scar. This change is temporary and will improve with time.

In addition, the normal healing process involves a period of skin contraction, which often peaks 4 to 6 weeks after the surgery. The body can often be lazy to dissolve all the deep sutures, and one or two can pop out like a pimple. Use a warm compress until you can be seen for our staff to help remove the spitting suture. Because all scars contract, the scarline is intentionally made to appear slightly bumpy on purpose. The deep sutures dissolve over 6-12 months, but until all the collagen is remodeled, the scar may feel hard or bumpy. On the face, this change is nearly always temporary and the scar will soften and improve with time. Sometimes injection of a medication is needed to soften the scar if it remains firm and raised (hypertrophic or keloid), which is more common to occur on the chest, upper back, and shoulders. You can use silicone gel or sheets to reduce this risk (see wound care handout).

Will my basal cell or squamous cell skin cancer turn into a melanoma?

No. Basal cell carcinomas and squamous cell carcinoma do not turn into melanoma. They are totally different types of cancer, with different cell types. One does not turn into another.

Why did it take so long for my skin cancer to be diagnosed?

Your cancer may have been looked at by a doctor who reassured you it was nothing to worry about, or that it was a precancerous spot and only needed a freezing treatment. It may have only been diagnosed when the appearance of the lesion began to change. Some skin cancers are easy to spot, while others can be very difficult to detect. This can lead to a delay in diagnosis. This does not mean that your doctor made a mistake when the skin cancer was not recognized initially.

What would happen if I leave the area alone and do nothing?

The vast majority of skin cancers are not fully removed with the biopsy. Having a biopsy is like having the top of the weed cut off. Left alone, the skin cancer will continue to grow. Deeper and wider. Basal cell skin cancer rarely spreads to distant organs, but it will keep growing, invading and destroying surrounding tissues. If neglected, basal cell cancers can become inoperable, disfiguring, and can result in death. Squamous cell carcinoma may metastasize or spread to distant sites of the body if not treated. Once metastasized, cancer becomes much more difficult to treat and may result in serious disability or death.

What are the chances of getting another skin cancer?

Many studies have looked at this, and it appears that 4 out of 10 people (40%) will get another skin cancer in the next 2-4 years. This is why it is so important to have regular full skin exams with your dermatologist, on a semi-annual basis. If you had a melanoma, you should be seen every 3 months and have your eyes (retinas) examined once a year.

Are there alternatives to Mohs surgery? Many different treatments can be used for skin cancer, but the appropriate treatment for an individual cancer depends on multiple factors. These factors include the pathologic characteristics of the cancer, the size of the tumor, the location of the tumor, the depth of tumor invasion, whether or not the cancer has been treated in the past, and the patient's overall health, among others. Other possible treatment options include:

- **Electrodesiccation and curettage** (scraping and burning): this technique is often used for superficial skin cancers on the trunk, arms and legs where there is skin to spare. However the recurrence rates can be quite high, and the scar may be large and noticeable. The wound also takes 2 months to heal, with daily bandage changes.
- **Simple excision**: when a lesion is excised, a fixed margin or normal skin must be removed around the tumor, usually 4mm. This is not a problem in areas with skin to spare, but on the face, hands and scalp, where the skin is often very tight, narrow margins are preferred. The specimen is cut like a bread-loaf, and only a few slices are checked by the pathologist. Even when the margin is read as "clear" by the pathologist, 1 in 20 patients will have a recurrence. This is much higher recurrence than the 1 in 1,000 that recur after Mohs surgery. Furthermore, an excision may not remove the entire skin cancer; in this case, an additional surgical procedure is required.
- **Chemotherapy creams**: While using a cream is an appealing option, they do not penetrate deeply into the skin, and so only very specific types of skin cancer are appropriate for treatment with creams. Creams must be used for several months to work, and may cause severe skin irritation. Up to 1/3 of skin cancers treated with creams will recur, and may be larger than they were initially because the deep portion, or roots, have enlarged in size. Creams can only be used on very thin or superficial skin cancers.
- **Oral chemotherapies**: Inoperable basal cell carcinomas can be treated with a life-long, once daily drug that can have side effects such as hair loss, weight loss / loss of appetite and leg cramps. The medication is also very expensive and not always covered by insurance.
- **Radiation**: Patients who cannot tolerate surgery may elect to have radiation, which requires 6 weeks of daily trips to the hospital. However, if the cancer recurs, radiation damages the surrounding skin, and surgery is much more difficult. The scar from radiation is often porcelain white, pink and entirely hairless.

Is Mohs surgery the most cost-effective treatment option?

In the vast majority of cases, **YES**. Because Mohs surgery by a fellowship-trained Mohs Micrographic Surgeon offers the highest success rate with the smallest sacrifice of normal skin, most patients require only a single surgery. This surgery usually includes repair of the wound, as well. Because the procedure is performed by one doctor who serves as the skin cancer surgeon, pathologist, and reconstructive surgeon, only one set of fees is required. This is in contrast to other methods which may require additional surgeries, surgical center fees, and pathology readings in order to repair the wound and to treat the cancer if it is not completely removed. Each of these additional surgeries and pathology readings require separate fees, while a single Mohs surgery procedure includes all of these into one fee. If other methods are used to treat the cancer, rather than Mohs surgery, and the cancer recurs (e.g., 1 in 20 chance of recurrence with standard excision), then Mohs surgery is often the treatment of choice. ©JoannaChanMD.com