

ACMMS

American College
of Mohs Surgery

**FELLOWSHIP-TRAINED MOHS SURGEONS:
THE EXPERTS IN SKIN CANCER TREATMENT.**

Before and after

MOHS SURGERY:

**WHAT TO EXPECT
FOR PATIENTS**

mohscollege.org

JASON CASTILLO, MD, FACMS
RAMIN FATHI, MD, FACMS
BRIDGET MCILWEE, DO, FACMS
KIYANNA WILLIAMS, MD, FACMS





ABOUT THIS BOOK

Postoperative complications are rare following Mohs micrographic surgery (MMS).

Fellowship-trained Mohs micrographic surgeons are the experts in Mohs surgery and cutaneous reconstructive surgery, and in managing any resultant complications.

Your Mohs surgeon will guide you through the healing process. The aim of this resource is to help patients distinguish normal postoperative recovery from complications that may require further follow-up. This resource is not a replacement for advice from your surgeon.

This resource has been produced by the American College of Mohs Surgery (ACMS), sponsored by the ACMS Foundation's Mohs Surgeons Leading the Future (MSLF) program. The target audience for this resource is Mohs surgery patients.

AMERICAN COLLEGE OF MOHS SURGERY

FELLOWSHIP-TRAINED SKIN CANCER
AND RECONSTRUCTIVE EXPERTS.

Training you trust, experience you expect.

WHAT DOES IT MEAN TO BE A FELLOWSHIP-TRAINED MOHS SURGEON?

- 1-2 additional years training after 4-year dermatology residency
- Minimum 650 surgical cases during fellowship
- Competitive review and selection process to enter training
- Exposure to rare tumor pathology, challenging tumor locations, and complex wound reconstruction
- Training programs must pass a rigorous application and review process

**IS MY MOHS SURGEON
FELLOWSHIP-TRAINED?**

**LOOK FOR THE FACMS
DESIGNATION AFTER YOUR
SURGEON'S NAME.**

ADDRESS

American College of Mohs Surgery
555 East Wells Street, Suite 1100
Milwaukee, WI 53202-3823

WEBSITE

mohscollege.org

PHONE

+1(800) 500-7224

GLOSSARY

- **Anesthesia:** medicine to numb tissue during surgery.
- **Antibiotic:** medicine to kill bacteria.
- **Atrophic:** skin that is thin, stretched, or sunken in.
- **Cellulitis:** an infection in the skin and underlying tissues.
- **Contact dermatitis:** an allergic rash on the skin.
- **Defect:** the wound where skin is missing after surgical removal of skin cancer.
- **Dehiscence:** when a wound opens up after surgery.
- **Ecchymosis:** bruising.
- **Ectropion:** when the eyelid turns outward abnormally and does not cover the eyeball as it should.
- **Edema:** swelling.
- **Elliptical excision:** cutting out skin in an oval shape to close a wound into a straight line.
- **Erythema:** redness.
- **Fibrinous tissue:** a stringy, yellowish substance that can form over healing wounds.
- **Fellowship:** extra training for doctors after they finish medical school and residency.
- **Granulation:** tissue that grows in a wound as it heals.
- **Hematoma:** blood trapped under the skin.
- **Hypergranulation:** too much healing tissue in a wound.
- **Hypertrophic scar:** raised scar that stays within the initial wound.

- **Hyperpigmentation:** skin is darker than usual.
- **Hypopigmentation:** skin is lighter than usual.
- **Keloid:** raised scar that grows beyond the initial wound.
- **Koebnerization:** when a new rash or cancer appears in a place of prior surgery or skin injury.
- **Margin:** the edge of the skin that the doctor removes and checks under the microscope during surgery.
- **Mohs surgery:** skin cancer surgery where one doctor both cuts out the cancer and checks the tissue under the microscope to ensure cancer is fully removed.
- **Necrosis:** death of tissue.
- **Neuropraxia:** a nerve is stretched or injured during surgery.
- **Pathology:** the study of cells and tissues under the microscope to see if there is any disease.
- **Postinflammatory hyperpigmentation:** the skin looks darker after a rash, surgery, or injury.
- **Postinflammatory hypopigmentation:** the skin looks lighter after a rash, surgery, or injury.
- **Prophylactic:** a preventative measure.
- **Residency:** extra training for doctors after they finish medical school.
- **Skin flap:** skin that is moved from one area to another to repair a wound.
- **Skin graft:** skin that is taken from one area and put onto another to repair a wound.
- **Tumor:** a growth or mass of cells. Tumors can be benign (non-cancerous) or malignant (cancerous).

The

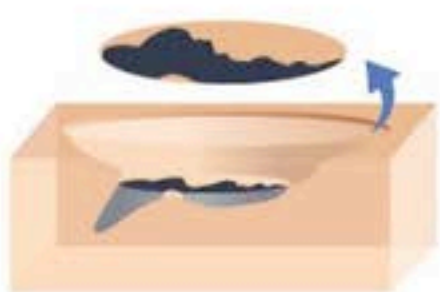
Mohs Surgery

Process



The roots of a skin cancer may extend beyond the visible portion of the tumor. If these roots are not removed, the cancer will recur.

1 Local anesthesia is injected to numb the area completely, and the visible portion of the tumor is removed.



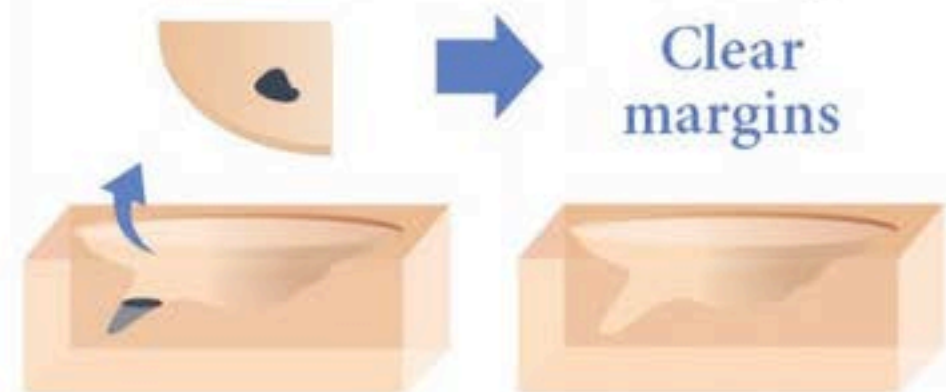
2 A first layer of tissue with a narrow margin around the tumor is surgically removed. The wound is bandaged temporarily while lab work begins.

3 The surgeon cuts the tissue into sections, color-codes them with dyes and draws a map of the surgical site. In the lab, the divided tissue is frozen and very thin horizontal slices are cut, placed on microscope slides and stained for examination.



4 The undersurface and edges of each tissue section are examined under a microscope by the surgeon for evidence of remaining cancer.

5 If cancer cells are found under the microscope, the surgeon marks their location on the “map” and returns to the patient to remove another layer of skin—but only from precisely where the cancer cells remain. This process is repeated until there is no evidence of cancer remaining.



6 The wound may be left open to heal or closed with stitches, depending on its size and location. In most cases, the surgeon will repair the wound immediately after obtaining clear margins. In some cases, a wound may need reconstruction with a skin flap, where neighboring tissue is moved into the wound, or possibly a skin graft. In some instances, your Mohs surgeon may coordinate repair with another specialist.

FOLLOWING MOHS SURGERY: YOUR POSTOP COURSE

- Some **bleeding** can be expected following MMS. As local anesthesia wears off following your surgery, small blood vessels may reopen and result in bleeding. Postoperative bleeding can be typically managed with thirty minutes of uninterrupted pressure with your hand over the surgical bandage. This can be repeated, ice can be applied over the pressure bandage, or the bandage reinforced if persistent bleeding occurs.
 - Postoperative hematoma is a potential complication of any surgery. A **hematoma** typically appears as a growing, hard lump under the skin, and may appear bruised. You should call your surgeon if you notice these symptoms.
 - Your surgeon may prescribe prophylactic antibiotics or want to intervene surgically to help reduce bleeding. The estimated rate of hematomas following MMS varies, but in most studies this occurs in <1% of MMS cases. (1)

- Postoperative infection commonly presents as cellulitis, which is defined as increased redness, warmth, tenderness around a surgical site. This typically occurs in the first 3-4 days of the postoperative period. If you notice your surgical site becoming increasingly red, hot, or tender, you should contact your surgeon.
 - Antibiotics are not commonly prescribed prior to or after MMS unless the surgery occurs on a high-risk body site, the planned reconstructive surgery carries a higher risk of infection, or you have specific medical history that warrants the use of prophylactic antibiotics.
 - Based on current literature, estimated infection rates after MMS range from 0-3%. (1,9,10,11)
- **Necrosis** describes the loss of tissue due to reduced or compromised blood flow to the skin. This complication, although rare, typically is used in describing grafts or flaps. This complication often presents itself as dusky-appearing skin at the repair site.
 - Necrosis can be defined as partial or full thickness depending on the depth of loss of tissue. Although not a common complication, if it does occur, it can be managed by your fellowship-trained Mohs micrographic surgeon.
 - Current literature show that necrosis is a rare postoperative complication following MMS. (11)

FOLLOWING MOHS SURGERY: YOUR POSTOP COURSE

- Dehiscence, or opening of a surgical repair, is rare following Mohs surgery. Dehiscence can occur immediately after surgery or in a delayed manner, depending on the tension of the surgical site.
 - The estimated rate of dehiscence varies, but two recent studies place the incidence at less than 1%. (11,12)
 - Management of dehiscence varies on a number of factors. If a dehiscence occurs, it is best to follow-up with your fellowship-trained Mohs micrographic surgeon for guidance and management.
- Discomfort varies widely amongst patients after Mohs micrographic surgery.
 - Studies have examined patient-reported pain scores following MMS, and show that most patients have tolerable discomfort that can be managed with short-term use of over-the-counter (OTC) analgesics like acetaminophen and ibuprofen. (13-14)
 - If your pain is not adequately managed by OTC medications, you should follow up with your Mohs surgeon.

INFORMATIONAL PATIENT EDUCATION VIDEOS FROM THE ACMS

Mohs surgery:

The Most Effective Treatment for Skin Cancer

<https://www.youtube.com/watch?v=F6TxdvjPk5I>

Postoperative Care after Mohs Surgery

<https://youtu.be/5XwWViMYcIA>



TABLE OF CONTENTS

1

NORMAL POSTOPERATIVE FINDINGS

1. Wound eversion
2. Wound versus incision size
3. Postoperative redness
4. Postoperative eyelid swelling and bruising
5. Second intention healing process
6. 5-fluorouracil treatment reaction
7. Normal skin flap healing progress
8. Normal skin graft healing process

WOUND EVERSION

After surgery, you may notice that your incision appears raised or bumpy compared to surrounding skin. This is called wound eversion, and it ensures the edges of the wound are brought together properly (or approximated). The incision will flatten with time - this may take several weeks after surgery.

WEEK 1



WEEK 6



WOUND VS. INCISION SIZE

After the removal of cancer during Mohs surgery, a defect or wound is left behind. To ensure proper healing and minimal scarring, the wound is closed using a technique called an elliptical excision. This involves removing two small triangles of skin on either side of the defect, allowing the remaining skin to be pulled together and sutured. While this technique may leave a longer scar, roughly 3 to 4 times the size of the original defect, it ensures a smooth and flat surface for optimal wound healing.

DEFECT & PLANNED REPAIR



REPAIR

3 MONTHS



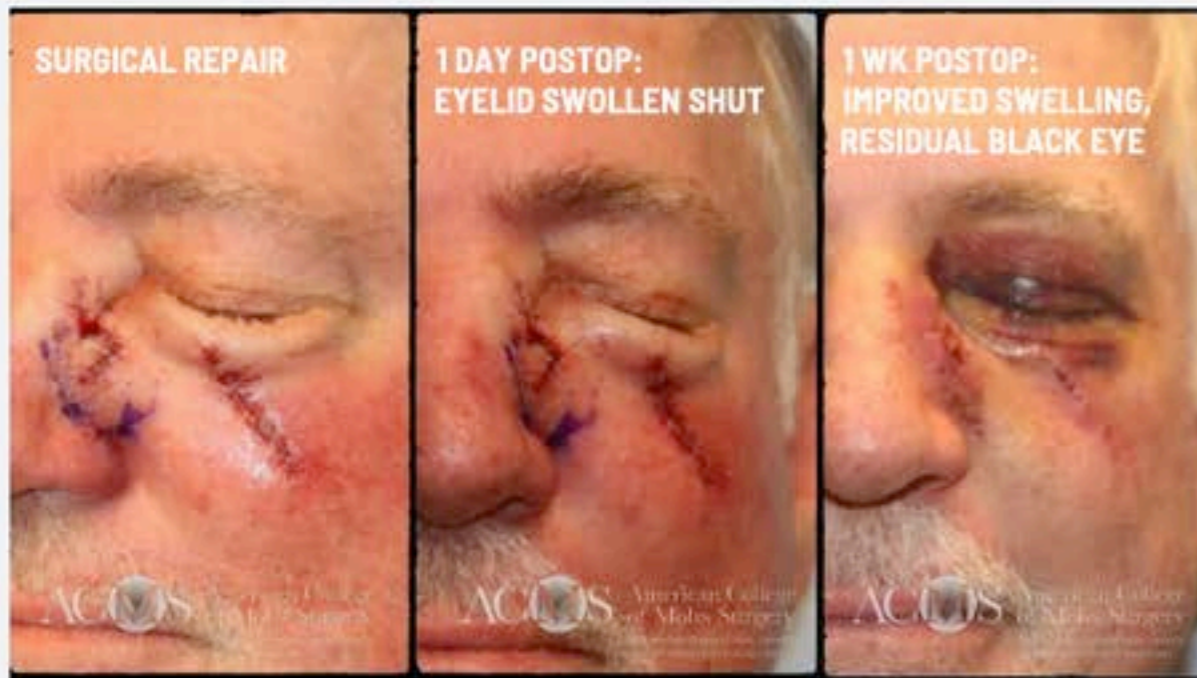
POSTOPERATIVE REDNESS

Postoperative erythema, or redness, is a common and expected finding after Mohs surgery. This is a sign of healing and typically resolves within a few days to a week. However, pigmentary changes after surgery (postinflammatory hyper- or hypopigmentation) are common, can also present as pink skin, and can persist for over a year after surgery.



POSTOPERATIVE EYELID SWELLING AND BRUISING

Swelling after Mohs surgery is a common and expected postoperative finding. It is a sign that the body is healing. Swelling and bruising around the eyes can occur after surgery on the *eyes, nose, cheek, forehead, or scalp*. You may develop a black eye, and sometimes the eye may even swell shut. Swelling and bruising around the eyes can take several weeks to fully resolve.



2 WEEKS POSTOP: POSTACUTE HEMATOMA ON FOREHEAD; SWELLING OF LEFT EYE; RESOLVING BRUISING OF FOREHEAD, BOTH EYES, LEFT CHEEK, JAWLINE, AND NECK.

SECOND INTENTION HEALING



Allowing a surgical wound to *heal on its own* is called healing by second intention. As your wound heals, you will see it fill in with fresh, pink granulation tissue. Granulation tissue sometimes appears with a yellow coating over the top of it - this is fibrinous tissue. Both tissues are normal parts of the healing process. Depending on the body site and the size and depth of your Mohs wound, it can take *weeks or even months* for a wound to fully heal.

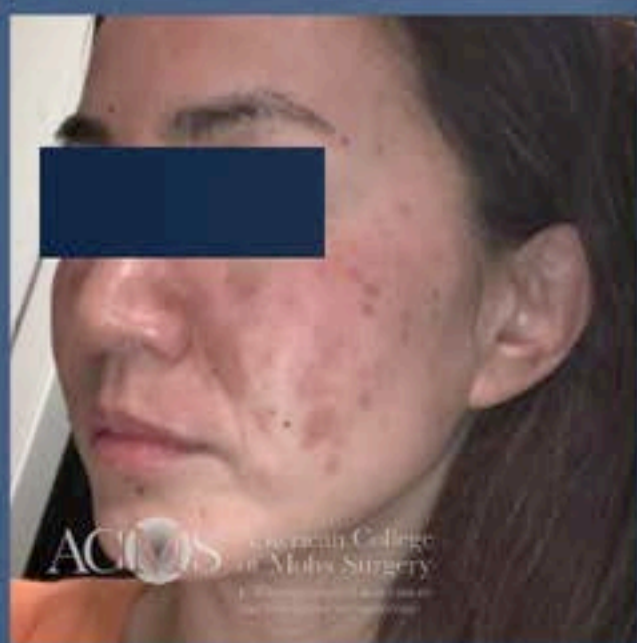


5-FLUOROURACIL TREATMENT

5-fluorouracil cream is commonly used for the treatment of pre-cancers (*actinic keratoses*) and early skin cancers.

Normal reactions include redness, scaling, stinging, itching, and rawness of the skin. This irritation is expected and is a sign that the medication is working. Your skin may remain red for a few weeks after finishing the treatment.

Gentle skin care is typically advised to help reduce inflammation and aid the healing process. In skin of color patients, darkening after treatment - or **postinflammatory hyperpigmentation** - can commonly occur. Strict sun protection reduces this risk.



SKIN FLAP HEALING PROCESS

A skin flap is a reconstructive procedure utilized by Mohs surgeons to repair postoperative wounds. Skin flaps allow your fellowship-trained Mohs surgeon to repair the surgical wound by utilizing extra tissue nearby. It is important to remember that the removal of your skin cancer and the subsequent reconstruction are a major surgery, from which you will take time to heal. During the healing process, it is normal to see elevation or bumpiness of the flap incision, a darker discoloration of the skin where the sutures are (this may be pink or brown, depending on your skin tone), and swelling of surrounding tissue. These findings will resolve with time.

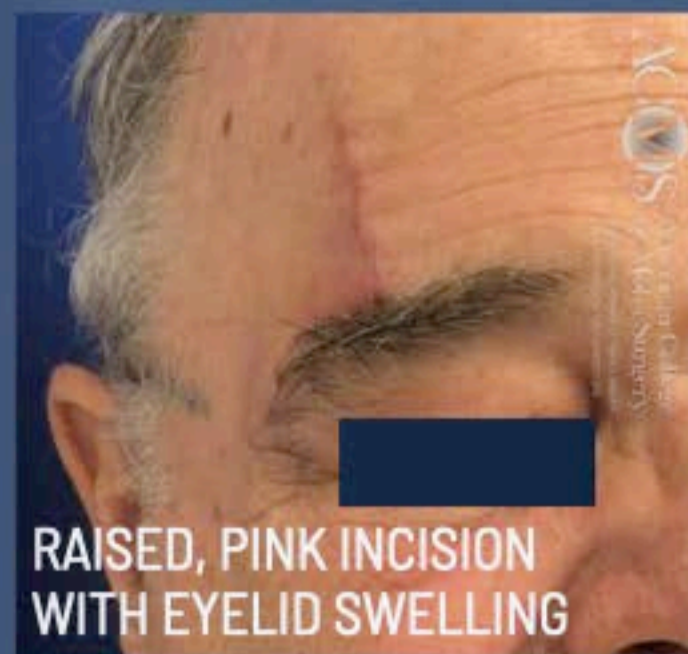
SURGICAL DEFECT



REPAIR OF WOUND WITH SKIN FLAP



RAISED, PINK INCISION WITH EYELID SWELLING



FINAL SCAR APPEARANCE



SKIN GRAFT HEALING PROCESS

After placing a skin graft, Your Mohs surgeon may or may not suture a dressing called a bolster over your graft. The healing process of a skin graft involves several stages: initial attachment, the formation of new blood vessels, and maturation. During these stages, the body works to secure the graft to your underlying tissue, healing and restoring a natural appearance to the affected area. It is important to remember that the removal of your skin cancer and the subsequent reconstruction are a major surgery, from which you will take time to heal.



TABLE OF CONTENTS

2

POSTOPERATIVE COMPLICATIONS

1. Infection/cellulitis
2. Hematoma
3. Complications of wound healing
 - a. Wound dehiscence
 - b. Flap necrosis
 - c. Graft necrosis
 - d. Hypergranulation/pyogenic granuloma
4. Suture reactions
 - a. Spitting sutures
 - b. Suture granuloma
 - c. Inflammatory suture reaction
5. Scarring
 - a. Hypertrophic scar
 - b. Atrophic/depressed scar
 - c. Ectropion
6. Complications of sensory and motor nerves
 - o Neuropraxia and nerve palsies
7. Pigmentary changes
 - a. Hypopigmentation
 - b. Hyperpigmentation
8. Contact dermatitis from bandaging/adhesives

INFECTION/CELLULITIS

Redness, swelling, and discharge or drainage can be signs of a wound infection after Mohs surgery. Cellulitis is a bacterial skin infection that typically affects the deeper layers of the skin and can spread rapidly. Both may be accompanied by fever or chills. Both conditions require prompt medical attention to prevent complications.



HEMATOMA

Hematoma, a collection of blood in the subcutaneous tissue, is a potential complication that can occur after Mohs surgery. It often presents as a hard, dark lump underneath or near your surgical site.

While a hematoma can appear concerning, with prompt medical care, the long-term prognosis is excellent. In most cases, a hematoma will resolve on its own within a few weeks to months. However, larger, more acute, or more persistent hematomas may require drainage or other medical intervention to prevent complications.



**SUBACUTE
HEMATOMAS ON
FOREHEAD AT 2
WEEKS POSTOP**



WOUND DEHISCENCE

Wound dehiscence is separation of the wound edges, which can result in delayed healing and an increased risk of infection. While wound dehiscence can appear concerning, proper wound care and follow-up appointments with your fellowship-trained Mohs surgeon can help to promote optimal wound healing and reduce the risk of any complications. Symptoms may include a visible opening in the wound, drainage, or discomfort. If you experience any of these, be sure to contact your fellowship-trained Mohs surgeon for guidance and proper wound care.



FLAP NECROSIS

Flap necrosis, or the death of a portion or all of a skin flap, is caused by the loss of blood supply to a skin flap. This causes loss of tissue and delayed healing. Symptoms may include a visible darkening or discoloration of the flap, a foul odor, or drainage. While flap necrosis can appear concerning, prompt medical attention can prevent further complications. Treatment may include ongoing wound care, surgical revision of the flap, or other interventions. Follow-up appointments with your fellowship-trained Mohs surgeon are crucial for monitoring the area and ensuring optimal wound healing.



GRAFT NECROSIS

Graft necrosis describes loss of the viable skin of a graft, typically due to interrupted blood flow. The graft necrosis, or failure, can be partial or complete, and typically needs evaluation by your surgeon to determine if further intervention is needed..



HYPERGRANULATION & PYOGENIC GRANULOMA

Hypergranulation is characterized by the overgrowth of granulation tissue at a wound site, which can result in delayed healing and an increased risk of infection. Pyogenic granulomas are similar, but do not always appear at the site of a surgical wound. Symptoms may include a visible mass of tissue, redness, bleeding, or discomfort. While hypergranulation can appear concerning, proper treatment and follow-up appointments with your fellowship-trained Mohs surgeon will promote optimal wound healing. In some cases, additional medical intervention may be necessary, such as silver nitrate treatment or surgical removal of the tissue.



SUTURE REACTIONS

Spitting sutures are caused by the body's natural healing process. The sutures are pushed through the skin surface as the wound heals. While spitting sutures can be uncomfortable and concerning, they are not serious and will resolve on their own. It is important to avoid touching or pulling on the sutures, as this can lead to infection or other complications.

Suture granulomas are a localized inflammatory response caused by the body's reaction to suture material under the skin. Symptoms may include a small bump or mass at the site of a suture, redness, or discomfort. While suture granulomas can be uncomfortable and unsightly, they are typically not serious and can be managed with proper wound care. If you experience any symptoms of a suture granuloma after surgery, be sure to contact your fellowship-trained Mohs surgeon for guidance and proper wound care.

Inflammatory suture reactions can be caused by absorbable sutures that are placed below the skin during surgery. These sutures vary in the length of time they take to fully dissolve and the amount of inflammation they can cause in the skin. If you have any concerns about your wound healing or sutures, contact your fellowship-trained Mohs surgeon for guidance.



ABNORMAL SCARRING

Hypertrophic scars are characterized by thick, raised, and discolored scar tissue that forms at the site of a wound. **Keloids** are similar to hypertrophic scars, but differ in that keloids extend past the wound margins. Treatments for hypertrophic scars or keloids include topical silicone gel or sheeting, corticosteroid injections, laser therapy, and surgical scar revision..

Atrophic or depressed scars are characterized by thin, sunken scar tissue that forms at the site of a wound. Treatment may include laser therapy, microneedling, and dermal fillers. In some cases, surgical scar revision may also be recommended.

Ectropion is a type of scarring characterized by an outward turning of the eyelid, which can result in dryness, irritation, and tearing of the eye. Treatment may include wound care, taping of the eyelid, or surgical revision of the area.



NEUROPRAXIA & NERVE PALSIES

Neuropraxia is a temporary nerve injury that can occur after Mohs surgery, particularly in areas with delicate nerves, such as the face.

Symptoms may include numbness, tingling, or weakness in the affected area. While nerve injuries can be concerning, neuropraxia typically resolves on its own within a few weeks to months. In some cases, additional treatment may be necessary to promote healing and relieve symptoms.

Temporary or permanent nerve palsies - loss of nerve function - can occur after any surgery. This can lead to asymmetric movement of the muscles innervated by the nerve. Certain risk factors such as large tumor size (>3cm), high level of subclinical spread, aggressive tumor histology, recurrence, and patient immunosuppression may increase the risk of nerve damage during surgery.



PIGMENTARY CHANGES

Hyperpigmentation, or darkening of the skin, can occur after Mohs surgery. It may be caused by increased production of melanin, the pigment that gives skin its color. Depending on your skin tone, hyperpigmentation may appear pink, red, brown, or black. Postinflammatory hyperpigmentation is usually temporary and the skin color will gradually return to normal over time (this may take months). However, in some cases, the hyperpigmentation may be permanent.

Hypopigmentation, or loss of skin color, can occur after Mohs surgery and may be caused by damage to pigment-producing cells in the skin. While postinflammatory hypopigmentation can be concerning, in most cases it is temporary and the skin color will gradually return to normal over time. However, in some cases, the hypopigmentation may be permanent.



CONTACT DERMATITIS FROM ADHESIVE BANDAGES

Contact dermatitis typically occurs as a red rash around the surgical site. Common causes include bandages, cleaning agents used during surgery, topical antibiotics, and types of skin adhesives. Typically the rash occurs in a geometric shape, similar in shape or area of the bandage or topical agent applied to the skin.



REFERENCES

1. Merritt BG, Lee NY, Brodland DG, Zitelli JA, Cook J. The safety of Mohs surgery: a prospective multicenter cohort study. *J Am Acad Dermatol.* 2012;67(6):1302-1309.
2. Kirkorian AY, Moore BL, Siskind J, Marmur ES. Perioperative management of anticoagulant therapy during cutaneous surgery: 2005 survey of Mohs surgeons. *Dermatol Surg.* 2007;33(10):1189-1197.
3. Kovich O, Otley CC. Perioperative Management of Anticoagulants and Platelet Inhibitors for Cutaneous Surgery: A Survey of Current Practice. *Dermatologic Surgery.* 2002;28(6):513-517.
4. Kovich O, Otley CC. Perioperative management of anticoagulants and platelet inhibitors for cutaneous surgery: a survey of current practice. *Dermatol Surg.* 2002;28(6):513-517.
5. Billingsley EM, Maloney ME. Intraoperative and postoperative bleeding problems in patients taking warfarin, aspirin, and nonsteroidal antiinflammatory agents. A prospective study. *Dermatol Surg.* 1997;23(5):381-383; discussion 384-385.
6. Otley CC, Fewkes JL, Frank W, Olbricht SM. Complications of cutaneous surgery in patients who are taking warfarin, aspirin, or nonsteroidal anti-inflammatory drugs. *Archives of dermatology.* 1996;132(2):161-166.
7. Doherty JU, Gluckman TJ, Hucker WJ, et al. 2017 acc expert consensus decision pathway for periprocedural management of anticoagulation in patients with nonvalvular atrial fibrillation: a report of the american college of cardiology clinical expert consensus document task force. *J Am Coll Cardiol.* 2017;69(7):871-898.
8. Siscos SM, Neill BC, Singh AH, Hocker TLH. Thrombotic complications with interruption of direct oral anticoagulants in dermatologic surgery. *J Am Acad Dermatol.* 2021;84(2):425-431.
9. Maragh SLH, Brown MD. Prospective evaluation of surgical site infection rate among patients with Mohs micrographic surgery without the use of prophylactic antibiotics. *J Am Acad Dermatol.* 2008;59(2):275-278.
10. Alam M, Ibrahim O, Nodzenski M, et al. Adverse events associated with mohs micrographic surgery: multicenter prospective cohort study of 20,821 cases at 23 centers. *JAMA Dermatol.* 2013;149(12):1378-1385.
11. Bordeaux JS, Martires KJ, Goldberg D, Pattee SF, Fu P, Maloney ME. Prospective evaluation of dermatologic surgery complications including patients on multiple antiplatelet and anticoagulant medications. *J Am Acad Dermatol.* 2011;65(3):576-583.
12. Nemer KM, Ko JJ, Hurst EA. Complications after mohs micrographic surgery in patients aged 85 and older. *Dermatol Surg.* 2021;47(2):189-193.
13. Firoz BF, Goldberg LH, Arnon O, Mamelak AJ. An analysis of pain and analgesia after Mohs micrographic surgery. *J Am Acad Dermatol.* 2010;63(1):79-86.
14. Sniezek PJ, Brodland DG, Zitelli JA. A randomized controlled trial comparing acetaminophen, acetaminophen and ibuprofen, and acetaminophen and codeine for postoperative pain relief after Mohs surgery and cutaneous reconstruction. *Dermatol Surg.* 2011;37(7):1007-1013.

ACMMS


American College of Mohs Surgery




**FELLOWSHIP-TRAINED MOHS SURGEONS:
THE EXPERTS IN SKIN CANCER TREATMENT.**

**IS MY MOHS SURGEON
FELLOWSHIP-TRAINED?**


**LOOK FOR THE FACMS
DESIGNATION AFTER YOUR
SURGEON'S NAME.**

ADDRESS 

American College of Mohs Surgery
555 East Wells Street, Suite 1100
Milwaukee, WI 53202-3823

WEBSITE 

mohscollege.org

PHONE 

+1(800) 500-7224