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Review of Dermato-Surgery Peri-Procedure Care Promoting Wound Healing

Charles W Lynde MD, FRCPC[1]; Joel Claveau MD, FRCPC, DABD[2]; Lyn Guenther MD FRCP[3]; Sameh Hanna MD, DABD[4]; Angela Law MD, FRCPC[5]; Monica Li MD, FRCPC[6]; Jaggi Rao MD, FRCPC[7]; Catherine Zip MD, FRCPC[8]; Anneke Andriessen PhD[9]

[1]Diplomate, American Board of Dermatology; Fellow, Royal College of Physicians and Surgeons of Canada; Associate Professor, Department of Medicine University of Toronto, Toronto, ON, Canada; Lynderm Research, Markham, ON, Canada. [2]Diplomate, American Board of Dermatology, Fellow, Royal College of Physicians and Surgeons of Canada, Associate Professor, Department of Medicine, Université Laval, Quebec City, QC, Canada, Director Melanoma and Skin Cancer Clinic, Le Centre Hospitalier Universitaire de Québec, Hôtel-Dieu de Québec, Quebec City, QC, Canada. [3]Diplomate, American Board of Dermatology; Fellow, Royal College of Physicians and Surgeons of Canada; Professor, Division of Dermatology, Department of Medicine Western University, London, ON, Canada. President Guenther Research Inc. [4]Diplomate, American Board of Dermatology; Fellow, Royal College of Physicians and Surgeons of Canada; Division of Dermatology, University of Toronto, Dermatology on Bloor, Yorkville, Toronto, ON, Canada. [5]Fellow, Royal College of Physicians and Surgeons of Canada; Clinical Instructor, Department of Dermatology and Skin Science University of British Columbia, Vancouver; Clinic One Three Eight Dermatology, Vancouver, BC. [6]Clinical Instructor, Department of Dermatology and Skin Science, University of British Columbia, Vancouver, BC, Canada, Diplomate, American Board of Dermatology, Fellow, Royal College of Physicians and Surgeons of Canada, Vancouver Skin MD, Vancouver, BC, Canada. [7]Diplomate, American Board of Dermatology; Fellow, Royal College of Physicians and Surgeons of Canada; Clinical Professor, University of Alberta, Edmonton, AB, Canada. [8]Diplomate, American Board of Dermatology; Fellow, Royal College of Physicians and Surgeons of Canada; Clinical Associate Professor, Department of Medicine, University of Calgary, Calgary, AB, Canada. [9]Radboud UMC Nijmegen, Andriessen Consultants, Malden, The Netherlands.

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ABSTRACT

Introduction: Over the years, the number of surgical excisions, cryosurgery, electrodesiccation, curettage, and facial laser treatment has increased. Presently pre- and post-procedural care and minor wound management remain highly variable, and standards are lacking. This review addresses peri-procedural treatment requirements to optimize outcomes, prevent infection, enhance comfort, and reduce downtime while reducing inflammation and time to healing.

Methods: A panel of eight Canadian dermatologists (panel) who perform dermato-surgery convened to discuss the findings of a structured literature search on peri-procedural measures for surgical excision, cryosurgery, electrodesiccation, curettage, and facial laser treatment. The information from the literature searches, together with the panels' expert opinions and experience, was applied in this review.

Results: Peri-procedural measures depend on individual patient factors and the type of treatment. Post-procedure moisturizer application may be beneficial for promoting wound healing. Studies have shown no differences in infection rates between post-procedural sites treated with topical antibiotics and petrolatum-based products. Moreover, topical antibiotics are among the top ten allergic contact dermatitis-causing agents.

Conclusions: Cutaneous healing should occur with minimal discomfort and an esthetic scar. Applying a moisturizer without an antibiotic was shown to be beneficial in promoting cutaneous healing. Standards for peri-procedural care and minor wound management may support healthcare providers in improving patient outcomes.

Key words: dermato-surgery peri-procedure care

Introduction

Over the years, the number of skin surgery procedures (surgical shave and elliptical excision, Mohs surgery, cryosurgery, electrodesiccation, curettage, electrodesiccation and curettage (ED&C), laser, and other facial rejuvenation treatments) has increased. The American Society for Dermatologic Surgery reported over 15.6 million cosmetic treatments performed in 2020 in the United States (U.S.) alone.[1] About 13.3 million of these were minimally invasive cosmetic procedures, including neuromodulator injections, soft tissue filler injections, microdermabrasion and chemical peels).[1] The top minimally invasive cosmetic procedures comprised neurotoxins 3.65 million (33%), dermal fillers 1.85 million (32%), skin treatment (chemical peels, hydro-facials) 1.39 million (6%), hair removal 0.45 million (2%), skin treatment (combination Lasers) 0.43 million (4%) and skin tightening 0.39 million (7%).[2]

While many guidance and consensus documents exist that describe best practices for performing skin surgery procedures, few discuss specific pre- and post-procedure measures. Surveys of aesthetic medicine providers confirmed a lack of consistency in the types and duration of peri-procedural measures for dermatosurgery, laser, and minimally invasive cosmetic procedures.[3,4] Presently, skin surgery pre and post clinical care and minor wound management remain highly variable and there are no standards,[3,4] however, cutaneous healing should occur with minimal discomfort and an esthetic scar. This review addresses peri-procedural treatment requirements to optimize outcomes, prevent infection, enhance comfort, and reduce downtime while reducing inflammation and time to healing.

Methods

The project aims to provide insights into skin conditions and lesions created when performing dermatosurgery, minimally invasive cosmetic procedures, and facial laser treatment, followed by developing standards for these measures.

A panel of eight Canadian dermatologists (panel) who perform skin surgery was convened to discuss the findings of a structured literature search on peri-procedural measures for surgical excision, cryosurgery, electrodesiccation, curettage, and facial laser treatment.

We searched PubMed and Google Scholar (secondary source) databases for studies published from 2010 until September 2022. We divided the search terms into four groups to allow optimal results and avoid duplications.

Group 1: *Pre-/post-procedure measures AND surgical excision OR curettage OR ED & C) OR cryotherapy OR facial laser treatment; AND Guidelines OR Algorithms OR consensus papers; AND Adverse events OR Complications OR Pain OR Bruising OR Swelling OR Discoloration OR Infection OR Reactivation of herpes simplex virus OR Antiviral medication OR Scarring OR Comfort OR Sun exposure; AND antimicrobial stewardship OR topical antimicrobials OR systemic antimicrobials*

Group 2: *Surgical excision, curettage, ED & C, cryotherapy AND healing by primary intent; AND post-procedure measures OR skincare OR topical wound treatment OR wound dressings*

Group 3: *Surgical excision healing by secondary intent; AND post-procedure measures OR skincare OR topical wound treatment OR wound dressings*

Group 4: *Peri-procedure measures for laser treatment; AND Guidelines OR Algorithms OR Consensus papers; AND Adverse events OR Complications OR Pain OR Bruising OR Swelling OR Discoloration OR Infection OR Reactivation of herpes simplex virus OR Antiviral medication OR Scarring OR Comfort OR Sun exposure OR Skincare OR wound healing regimen.*

Exclusion criteria were no original data, information not specific to peri-procedure measures for skin surgery, minimally invasive procedures, and facial laser treatment, and publication in a language other than English. The results of the searches were evaluated independently by two reviewers (AA, TE) and yielded 98 papers. After reviewing abstracts and removing duplicates and papers that did not contribute to this review (n = 43), fifty-five remained. Guidance and consensus documents are available on dermatosurgery, minimally invasive procedures, and facial laser treatment; however, few discussed peri-procedural measures and wound treatment which did not allow for grading.

Results

Procedures Included in the Review

The review addresses the following procedures: surgical excision, cryotherapy, electrodesiccation, curettage, ED&C, and facial laser treatment.

Surgical Excision

A Canadian national survey amongst dermatologists showed that epileptiform excisions, shave excisions, punch biopsies, curettage, and ED&C was most frequently performed, whereas Mohs micrographic surgery (MMS) was the least frequent procedure.[5] These procedures are used to remove benign and malignant lesions.[5]

Adverse events are usually minor and include bleeding, hematoma, wound dehiscence, infection, discoloration (post-inflammatory hyper (PIH) or hypopigmentation), and atrophic, hypertrophic, or keloid scar formation.[5]

Curettage and Electrodesiccation

Curettage or electrodesiccation can be used to remove benign (e.g. condyloma acuminatum, seborrheic keratosis, pyogenic granuloma, excess granulation tissue) and malignant lesions. With malignant lesions, curettage is often combined with electrodesiccation (ED&C) or cryotherapy. For many indications, ED&C has been replaced by curettage alone, as it yields similar cure rates and a better cosmetic outcome.[12-16] Dermatologists routinely perform these procedures in their offices.

The disadvantage of curettage with or without electrodesiccation or cryotherapy is the absence of histopathologic margin evaluation.[13-15] Studies on low-risk non-melanoma skin cancers show 5-year ED&C cure rates from 91 to 97%.[15,16]

Cryosurgery

Cryosurgery has several indications for both benign and malignant lesions. Benign lesions that can be treated with cryosurgery include seborrheic keratosis, verruca, skin tags, molluscum contagiosum, solar or senile lentigo, and actinic keratosis.[16-20]

In the case of exophytic lesions, curettage should be considered prior to cryotherapy. This procedure can be delivered quickly and cost-effectively in an outpatient setting. [16-20]

Recurrence rates of actinic keratoses treated with cryotherapy vary significantly (1–39%) in prospective studies likely due to a lack of homogeneity in patient and tumor selection, follow-up period, and inter-operator performance approach.[19,20] Malignant lesions can be treated with this modality, but the depth and extent of freezing may not be known without the use of a cryoprobe. Light cryotherapy often leaves no mark but may not remove the desired lesions. A deeper freeze may be associated with permanent white marks due to the destruction of melanocytes, postinflammatory hyperpigmentation, pseudoepitheliomatous hyperplasia, and depressed scars, which may resolve spontaneously, alopecia which may be permanent due to the destruction of hair bulge cells, and tissue distortion (e.g. nail dystrophy or notching of cartilage) due to damage to the nail matrix/cartilage.[16]

Cryosurgery should not be used for conditions that can be exacerbated by cold exposure (cryoglobulinemia, multiple myeloma, Raynaud disease, cold urticaria) and a previous history of cold-induced injury or poor circulation at the site or in that body part.[17] Vasoconstriction induced by cryosurgery in poorly perfused areas may lead to tissue necrosis.[17]

Facial Laser Treatment

Many different types of lasers are available, and laser treatment has many indications.[3] Pulsed dye lasers (PDL) may be used for the treatment of port wine stains in adults and children. A further indication for PDL may be the treatment of telangiectatic rosacea.[3] Other indications include radiodermatitis, ulcerated hemangioma, and erythrose of the neck.

For hair removal, various types of lasers, such as pulsed diode lasers, Nd: YAG lasers, or intense pulsed light (IPL) lasers, can be used.[3] With the proper preparation and an experienced provider, patients with richly pigmented skin can also safely undergo laser and light-based treatments for hair removal, pigment abnormalities, skin resurfacing, and skin tightening.[21] Facial rejuvenation aims to correct rhytides, telangiectasias, lentigines, and skin texture.[3] Laser and energy devices may be used for facial resurfacing, depending on clinical indication, individual subject characteristics, and the operator's expertise.[3,4] Lasers, such as CO2 or erbium laser, can be used to remove tattoos, Ota's nevus, and, to a lesser degree, liver spots and Becker's nevus.[3,21-24] These lasers permit dermabrasion in treating verrucous hematoma, extensive benign superficial dermo-epidermal lesions, and the esthetic treatment of non-muscular wrinkles, i.e., excepting wrinkles of the forehead and nasal sulcus.[21-24] Laser-assisted administration of photodynamic therapy (PDT) photosensitizers has demonstrated efficacy for superficial BCC.[25-27] The recurrence rates of BCC were markedly reduced in two randomized controlled trials using aminolaevulinic acid PDT with erbium compared to PDT and erbium.[25-27]

Cutaneous adverse events with all types of laser treatment, such as reactive hyperemia, edema, scarring, and discomfort, may occur.[3,21-24]

Pre-Procedural Measures

All Discussed Procedures

Skin conditions and infections can exacerbate and cause complications following skin surgery.[3,4,28,29] For all patients considering having a procedure done, medical history including current and previous treatments, including procedures for the lesion under question, what the patient and treating physician hope to accomplish with the proposed procedure, current medications, and allergies, history of systemic disease, history of abnormal wound healing such as post-inflammatory dyspigmentations, abnormal scarring.[3,4,28,29] In patients that have had previous surgical treatments anywhere on their body, it is often good to assess the resultant scars prior to agreeing to perform a procedure on the individual.

Before the procedure, patients should attend the clinic with clean skin without makeup or cosmetics in the area to be treated.[30-34] Hair should be secured away from the treatment area. Patients should not shave since shaving can cause micro-wounds and increase the risk of infection.

Curettage, Electrodesiccation, ED&C, and Cryotherapy

Typically, additional pre-procedural measures are not required.

Laser Treatment

Laser devices are frequently used for facial rejuvenation. Device and treatment choice depends on individual patient characteristics, expectations, and physician expertise.[22-24] For optimal treatment outcomes, patients should be appropriately selected and screened, followed by a physical exam before treatment, depending on the type of procedure.[23,24] Outcomes of previous skin or surgical treatments are obtained, especially dermabrasion (if previously performed) responses.[28,29] People with hypertrophic scars, keloids, or changes in pigmentation will need peri-procedural cosmetic practices to reduce the risk of these complications or should be advised against the procedure.[28,29] Previously published surveys and algorithms confirmed more than 90% of clinicians recommended sun avoidance before, during, and after facial cosmetic treatments.[3,28,29]

Peri-procedural measures are based on individual patient factors and the type of laser procedure.[21-24] For patients receiving ablative laser therapy, pre-treatment of underlying conditions, such as rosacea, dermatitis, and prevention of recurrences in patients with recurrent *Herpes simplex*, may reduce complications and enable adequate healing time to restore the skin's barrier function.[3,28] Check patients for remote infections. Caution should be applied when considering extensive laser procedures in patients with compromised immune systems, such as HIV, cancer treatment, immunotherapy, or poorly controlled diabetes.[3-28]

Measures During the Procedure

Surgical Excision

Prior to the procedure, the surgical site may be prepared with chlorhexidine (2%), isopropyl alcohol (70%), or hypochlorous acid (HOCL).[30-34] Povidone iodine is less commonly used since it is messy and permanently stains clothing. Chlorhexidine is an effective cleanser but may induce allergic contact dermatitis and can be toxic to the eyes and ears, whereas isopropyl alcohol is

flammable and can irritate the skin.[31,32] Stabilized HOCL is highly active against bacteria, viruses, and fungal organisms without chlorhexidine's oto or ocular toxicity; it has been proposed as a future gold standard for wound care.[33] HOCL has been shown to have dose-dependent favorable effects on fibroblast and keratinocyte migration compared to povidone-iodine and media alone.[33,34] It also increases skin oxygenation at treatment sites which may aid healing. There is evidence that HOCL may reduce the risk of hypertrophic scars and keloids as it reduces inflammation and the risk of infection. [33,34]

Local anesthesia and pain management can be customized depending need based on the procedure and patient factors and added at the treating physician's discretion.

Cryosurgery, Electrodesiccation, Curettage, ED&C

Minimal skin preparation is needed for cryosurgery, ED or curettage if the procedure does not result in bleeding. Therefore, antiseptics are not typically indicated in the majority of procedures.[16] However, topical antiseptics should be applied to lesions that are to be curetted or treated with ED&C.[16]

Pain management can be customized depending on the procedure and added at the treating physician's discretion. Pre-procedure anesthesia should be considered for lesions to be curetted or treated with ED&C and large or extensive lesions. Topical anesthetics applied several hours before the procedure or intralesional anesthesia can help reduce surgical pain. For small lesions, injection of local anesthetic may be more painful than the procedure itself and is therefore not indicated.

Laser Treatment

Before the procedure, makeup removal and skin cleansing using a gentle cleanser is required.[30-34] The treatment site is prepared with chlorhexidine (2%), isopropyl alcohol (70%), or hypochlorous acid (HOCL).[30-34] Local anesthesia and pain management can be customized depending on the procedure and added at the discretion of the treating physician.[28,29]

Post-Procedural and Wound Healing Measures

Surgical Excision Healing by Primary Intent

A local anesthetic given before the procedure takes about 1-2 hours to wear off. For further pain management post-surgery, oral acetaminophen is preferred over aspirin, naproxen, or ibuprofen, as the latter encourages bleeding.

Topical postoperative wound care involves maintaining a protected wound and a clean, moisturized surface.[35,36] Wound care includes cleansing with either a gentle cleanser or water, applying a topical, and covering the wound with a dressing.[35,36] While previous investigators have evaluated methods for reducing risks of adverse events due to the treatment procedure, robust studies on post-procedural wound management for primarily closed wounds are lacking.[35-38]

Physicians typically cover sutured wounds using either a dressing, adhesive tape strips, or both.[35-38] Wound dressings can be classified according to their function, material, and physical form of the dressing (Table 1).[35] Wound dressings for sutured wounds are typically left in place for [24- 48] hours after surgery. [35-37] If there is

Phase of Healing	Classification/Type	Primary Intention Healing	Secondary Intention Healing
Initial phase	Function	Keep the suture line dry, clean, and protected against damage	Absorb exudate, nonadherent, donate fluid, maintain a moist wound healing environment,
	Type of material	Dry surgical dressing or adhesive tapes	Hydrocolloid, foam, alginate, hydrogels, film dressings
Inflammation/tissue formation	Components and format	White petrolatum, ointment	
		Water-free petrolatum, humectants, and lipids, ointment	
		Madecassoside, panthenol, copper-zinc-manganese, cream, emollient, drops, gel, lotion, oil, ointment, solution, and spray	
		HOCL, solution, spray, gel	
		Silicone gel, sheeting	
Prevention/treatment of scarring	Components and format	Self-adhesive propylene glycol and hydroxyethyl cellulose sheeting	

Table 1: Types of wound dressings and moisturizers

a lot of tension on the wound or bleeding during the procedure, the dressing is typically left on for 2 or more days. The dressing can act as a physical barrier to protect the wound until skin continuity is restored and to absorb exudate from the wound, and prevent bacterial contamination from the external environment.[35-37] Some studies have found that the moist environment created by some dressings accelerates wound healing, although excessive exudate can cause maceration of the suture line and peri-wound skin.[35-37] A dressing should absorb wound exudate, minimize maceration and prevent bacterial contamination.[36]

The utility of dressing surgical wounds beyond 48 hours of surgery is controversial, although [35-37] in addition to the above, dressings can prevent irritation from rubbing from clothing.

A systematic review on early versus delayed dressing removal after primary closure of clean superficial wounds found no detrimental effect on the patient when removing the dressing after 24 hours.[35] However, the point estimate supporting the conclusion is based on very low-quality evidence.[35]

Cleansing the suture line after dressing removal post-procedure using an antimicrobial solution or applying an antimicrobial ointment is equally controversial.[35,36]

The incidence of surgical site infections (SSI) varies between 1% and 80% depending upon the types of surgery, the hospital setting (community hospital, tertiary-care hospital, etc.), the classification of surgical wounds, and the method of skin closure.[35] In addition, many skin surgeries are performed in the community in physician offices where infection rates range from 0.2% to 2.5%.[41] Antimicrobial resistance is a growing concern, especially when antimicrobial products are used routinely and inappropriately.[39-44] Moisturizers are frequently used to keep the wound moist; however, evidence for beneficial effects on sutured wounds is inconclusive and mainly from small studies.[45-50]

After suture removal, the topical application of a moisturizer containing madecassoside, panthenol, and copper-zinc-manganese has been shown to be beneficial.[45-48] The product is available as a cream, emollient, drops, gel, lotion, oil, ointment, solution, and spray in a concentration of 2-5%.[45-48] Petrolatum jelly and water-free petrolatum-containing ointments or products containing HOCL may also be used postoperatively to keep the wound moist, however, since they are occlusive, they may induce maceration.[49,50]

In a study on postoperative wound care after MMS procedures (N = 76) patients were randomized to wound care with an ointment containing petrolatum, humectants, and natural barrier lipids (group 1: n = 27), white petrolatum (group 2: n = 32) or no ointment (group 3: n = 17).[50] Group 1 demonstrated an incidence of swelling and erythema of 52% (14/27); in group 2 erythema occurred in 12% (4/32) and swelling and erythema in 9% (3/27); and in group 3 erythema was noted in 12% (2/17) and swelling and erythema in 6% (1/17) patients.[50] The use of antibiotic-containing ointments is best avoided as they may cause allergic reactions and contribute to antimicrobial resistance.[39-44] Moreover, the rate of surgical site infections in minor surgical wounds is low and preventive use of topical antibiotics is not indicated.[35,44-52]

If a hypertrophic scar develops, treatment with a silicone gel sheet or gel may improve the scar appearance and pain. Another option is self-adhesive propylene glycol and hydroxyethyl cellulose sheeting; however, evidence of the efficacy of these products in improving scar appearance and reduction of pain is inconclusive.[53]

Surgical Excision, Curettage, ED&C, and Cryosurgery Healing by Secondary Intent

In a simplified model, wound healing processes occur in four phases 1) vascular response, 2) coagulation, 3) inflammation, and 4) new tissue formation.[54-57] During the initial inflammatory phase, the adaptive immune system is activated to prevent infection at the wound site.[54-57] Macrophages remove neutrophils, bacteria, and debris from the wound site. They then change phenotype to M2 macrophages, starting the proliferative and epithelialization phase, producing anti-inflammatory mediators and extracellular matrices.[54-57] If this phase is hindered, wound healing may be disturbed. The proliferative or epithelialization phase overlaps with the inflammatory phase and usually takes two to three weeks post-procedure.[54] During this phase, the dermal matrix matures, and inflammatory processes continue in the reticular dermis. The reticular dermis is sensitive to wound stress and infection and is affected by patient-related conditions such as age, sun exposure, or genetic profile.[54-57] Persistent inflammation plays a role in the development of hypertrophic or keloid scars, although it may not be the entire cause.[54-57] During the remodeling phase the wound contracts, and collagen remodeling occurs, which can last for up to a year post-procedure.

Pain management is similar to that previously discussed for primary healing wounds.

Patients should be instructed to avoid sun exposure to the treated area, along with sun protection measures such as sunscreen with SPF 50 plus UVA block to prevent discoloration.[3,4,28,29]

When a dressing is used post-procedure, the patient should be instructed to keep it dry and leave it in place for 24-48 hours. After dressing removal, a gentle, non-irritating cleanser can be used twice daily to cleanse the treated area.[3,4,28,29] The wound site

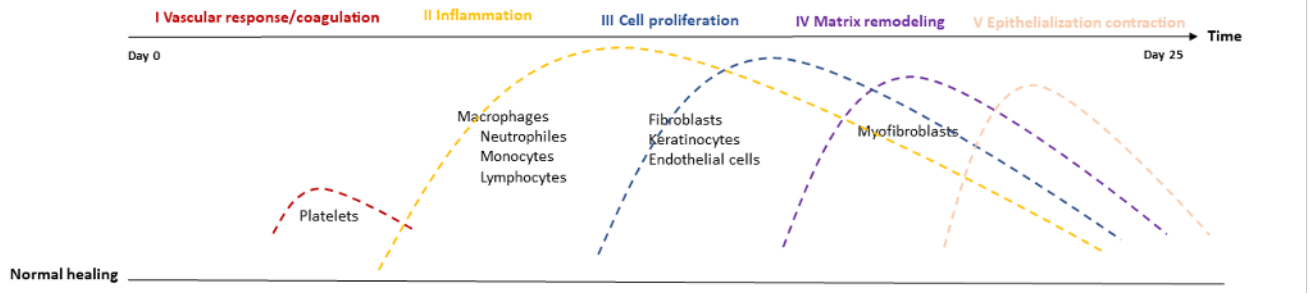

Figure 1: Time sequence of normal wound healing

must be handled with care, particularly during the initial healing phase of 7-10 days when newly formed epithelium can be early inadvertly removed.[3,4,28,29]

Moisturizers or products containing HOCL may be applied to keep the wound moist and to promote wound healing (Table 2).[49,50] Similar to what was discussed for sutured wounds, moisturizers containing antibiotics should not be used on wounds not showing signs of infection to avoid allergic reactions and antimicrobial resistance.[39-44,49-52]

A moisturizer containing madecassoside, panthenol, and copper-zinc-manganese may be beneficial.[45-48] It is available as a cream, emollient, drops, gel, lotion, oil, ointment, solution, and spray in a concentration of 2-5%.[45-48,59] In an unpublished international observation study, 11,464 adults, children, and infants with a mean age of 31 years (1 week to 97 years) with superficial wounds applied the ointment for 14 days. Clinical (desquamation, cracks, erosion, erythema) and subjective symptoms (tightness, pain, burning sensation, pruritus) showed a significant improvement at 14 days, while tolerance and esthetic aspects of the ointment were rated good.

Wound Healing After Laser Procedures

For patients undergoing ablative procedures, prophylactic oral antivirals such as acyclovir (400 mg orally three times daily) or valacyclovir (500 mg orally two times daily), starting typically one day before resurfacing and continuing for 6–10 days post-procedure may be indicated.[3,28] Patients undergoing ablative laser treatment with baseline melasma or post-inflammatory hyperpigmentation may require pre-procedure lightening agents such as hydroquinone 2-4% cream twice per day in the morning and evening.[3,28]

Gold and colleagues developed an algorithm for pre-/post-procedure measures for facial laser and energy device treatment and listed complications from laser treatment and actions that can be taken (Table 2).[28]

Post-laser management is similar to that discussed for secondary healing wounds.

Limitation

Although few studies on peri-procedural measures for dermato-surgery care and minor wound management are available, the advisors recommend applying a moisturizer without antibiotics for antimicrobial stewardship and contact allergy avoidance.

Conclusion

Peri-procedural measures depend on individual patient factors and the type of dermato-surgery. Standards are required to support healthcare providers to optimize outcomes, prevent infection, enhance comfort, and reduce downtime while reducing inflammation and time to healing. Applying a moisturizer without an antibiotic was shown to be beneficial in promoting cutaneous healing. Studies are required to evaluate purpose-designed moisturizers for dermato-surgery post-procedural application improving patient outcomes.

Adverse Event	Details
Pain	Each laser pulse's snapping and burning sensation can produce a minimal to moderate amount of discomfort.
Purpura, bruising	Immediately after the laser treatment, the area will sometimes appear grey or blue-black in color. The discoloration will fade over the next 7–10 days.
Swelling	Within a few minutes after the laser treatment, erythema and edema may occur over the treatment area. Areas most likely to swell are under the eyes and neck. The swelling subsides within 3–5 days if ice is regularly applied. Parallel and post-cooling will diminish the amount of edema.
Discoloration, blisters, scabs	These adverse events rarely develop and are mostly caused by overtreatment. Grey or pale white discoloration of the epidermis is a sign of early dermal damage and will last only a few seconds.
Blister formation, epidermal disruption, and epidermal necrosis (dermal in severe cases)	Intense cooling, radiant exposure reduction, and pulse duration prolongation should be considered. These can take 1–2 weeks to resolve. The findings can be immediate or delayed. Treat a test spot for at least 5 min before proceeding with full treatment.
Infection. Swelling, redness, crusting, pain, and fever	Topical antiseptics or oral antibiotics should ideally be used for presumed infection after taking a wound culture.
Reactivation of herpes simplex on the face.	Prophylactic oral virostatic therapy is recommended when the patient has frequent herpetic recurrences (more than 6 per year), starting the day before laser treatment.

Table 2: Complications from laser treatment
Modified with permission from Gold et al *J Drugs Dermatol*. 2021;20:1(Suppl):s3-11[24]

References

1. American Society of Plastic Surgeons. Plastic surgery statistics report [document on the internet]. 2020 [cited 2023 Jan 10]. Available from: https://www.plasticsurgery.org/documents/News/Statistics/2020/plastic-surgery-statistics-full-report-2020.pdf. Accessed Jan 10, 2023.
2. Aesthetic plastic surgery national databank statistics 2020–2021. *Aesthet Surg J*. 2022 Jun;42(Suppl 1):1–18.
3. Gold MH, Andriessen A, Cohen JL, et al. Pre-/postprocedure measures for laser/energy treatments: a survey. *J Cosmet Dermatol*. 2020 Feb;19(2):289-95.
4. Gold MH, Andriessen A, Goldberg DJ, et al. Pre-/postprocedure measures for minimally invasive, nonenergy aesthetic treatments: a survey. *J Cosmet Dermatol.* 2020 Jul;19(7):1587-92.
5. Freiman A, Rosen N, Sasseville D, et al. Dermatologic surgery practice and skin cancer treatment in Canada: results of a national survey. *Dermatol Surg*. 2005 Jan;31(1):27-32.
6. Canadian Dermatology Association. 2017 Skin cancer fact sheet [document on the internet]. 2017. Available from: https://dermatology.ca/wp-content/uploads/2017/11/2017-Skin-Cancer-Fact-Sheet.pdf
7. Canadian Cancer Society. Melanoma skin cancer statistics [Internet]. Canadian Cancer Society; [updated 2022 May]. Available from: http://www.cancer.ca/en/cancer-information/cancer-type/skin-melanoma/statistics/?region=on
8. BC Cancer. Skin, non-melanoma [Internet]. Provincial Health Services Authority; [updated 2021 Oct] Available from: http://www.bccancer.bc.ca/health-info/types-of-cancer/skin/skin-non-melanoma.
9. Gulleth Y, Goldberg N, Silverman RP, Gastman BR. What is the best surgical margin for a basal cell carcinoma: a meta-analysis of the literature. *Plast Reconstr Surg*. 2010 Oct;126(4):1222–31.
10. Prickett KA, Ramsey ML. Mohs micrographic surgery. Treasure Island (FL): StatPearls Publishing; 2021.
11. Connolly SM, Baker DR, Coldiron BM, et al. AAD/ACMS/ASDSA/ASMS 2012 appropriate use criteria for Mohs micrographic surgery: a report of the American Academy of Dermatology, American College of Mohs Surgery, American Society for Dermatologic Surgery Association, and the American Society for Mohs Su. *J Am Acad Dermatol.* 2012 Oct;67(4):531–50.
12. Fahradyan A, Howell AC, Wolfswinkel EM, et al. Updates on the management of non-melanoma skin cancer (NMSC). *Healthcare (Basel)*. 2017;5(4):82.
13. Ferry AM, Sarrami SM, Hollier PC, et al. Treatment of non-melanoma skin cancers in the absence of Mohs micrographic surgery. *Plast Reconstr Surg Glo Open*. 2020 Dec;8(12): e3300.
14. Bichakjian CK, Olencki T, Aasi SZ, et al. Basal cell skin cancer, version 1.2016, NCCN clinical practice guidelines in oncology. *J Natl Compr Cancer Netw*. 2016 May;14:574–97.
15. Blixt E, Nelson D, Stratman E. Recurrence rates of aggressive histologic types of basal cell carcinoma after treatment with electrodesiccation and curettage alone. *Dermatol Surg.* 2013 May;39(5):719–25.
16. Mazzoni D, Muir J. A guide to curettage and cautery in the management of skin lesions. *Aus J Gen Pract*. 2021;50(12):893-97.
17. Farhangian ME, Snyder A, Huang KE, et al. Cutaneous cryosurgery in the United States. *J Dermatolog Treat.* 2016;27(1):91-4.
18. Goldberg LH, Kaplan B, Vergilis-Kalner I, Landau J. Liquid nitrogen: temperature control in the treatment of actinic keratosis. *Dermatol Surg*. 2010 Dec;36(12):1956-61.
19. Basset-Seguin N, Ibbotson SH, Emtestam L, et al. Topical methyl aminolevulinate photodynamic therapy versus cryotherapy for superficial basal cell carcinoma: a 5 year randomized trial. *Eur J Dermatol*. 2008 Sep-Oct;18(5):547-53.
20. Thissen MRTM, Nieman FHM, Ideler AHLB, et al. Cosmetic results of cryosurgery versus surgical excision for primary uncomplicated basal cell carcinomas of the head and neck. *Dermatol Surg.* 2000 Aug;26(8):759-64.
21. Alexi s AF. Lasers and light-based therapies in ethnic skin: treatment options and recommendations for fitzpatrick skin types V and VI. *Br J Dermatol.* 2013 Oct;169 (Suppl 3):91-7.
22. Dierickx C. Using normal and high pulse coverage with picosecond laser treatment of wrinkles and acne scarring: long-term clinical observations. *Lasers Surg Med.* 2018 Jan;50(1):51–55.
23. Wu DC, Fitzpatrick RE. facial rejuvenation via sequential combined use of multiple laser modalities: safety and efficacy. *Lasers Surg Med*. 2016 Aug;48(6):577–83.
24. Ibrahimi OA, Saedi N, Kilmer SL. Laser-based treatment of the aging face for skin resurfacing: Ablative and nonablative lasers. *Aesthetic Surgical Procedures.* 2015;Part 3:549-60.
25. Choi SH, Kim KH, Song KH. Er:YAG ablative fractional laser primed photodynamic therapy with methyl aminolevulinate as an alternative treatment option for patients with thin nodular basal cell carcinoma: 12 month follow up results of a randomized, prospective, comparative trial. *J Eur Acad Dermatol Venereol.* 2016 May;30(5):783–8.
26. Lear JT, Migden MR, Lewis KD, et al. Long-term efficacy and safety of sonidegib in patients with locally advanced and metastatic basal cell carcinoma: 30-month analysis of the randomized phase 2 BOLT study. *J Eur Acad Dermatol Venereol.* 2018 Mar;32(3):372–81.
27. Nasr I, McGrath EJ, Harwood CA, et al. British association of dermatologists guidelines for the management of adults with basal cell carcinoma 2021. *Br J Dermatol.* 2021 Nov;185(5):899-20.
28. Gold M, Andriessen A, Goldberg DJ, et al. algorithm for pre-/post-procedure measures for facial laser and energy device treatment. *J Drugs Dermatol.* 2021 Jan;20:1(Suppl):s3-11.
29. Gold M, Andriessen A, Goldberg DJ, et al. Algorithm for nonenergy and injectable treatment pre-/post-procedure measures. *J Drugs Dermatol.* 2021 Nov;20(11):ss3s-s10s.
30. American Society for Dermatologic Surgery (ASDS). 2019 ASDS Consumer Survey on Cosmetic Dermatologic Procedures [document on the internet]. 2019 Oct [cited 2020 Mar 11]. Available from: https://www.asds.net/Portals/0/PDF/consumer-survey-2019-infographic.pdf
31. Bever GJ, Brodie FL, Hwang DG. Corneal injury from presurgical chlorhexidine skin preparation. *World Neurosurg.* 2016 Dec;96:610.e1-610.e4.
32. Steinsapir KD, Woodward JA. Chlorhexidine keratitis: safety of chlorhexidine as a facial antiseptic. *Dermatol Surg.* 2017 Jan;43(1):1-6.
33. Gold MH, Andriessen A, Bhatia AC, et al. Topical stabilized hypochlorous acid: The future gold standard for wound care and scar management in dermatologic and plastic surgery procedures. *J Cosmet Dermatol.* 2020;19(2):270-7.
34. Gold MH, Andriessen A, Dayan SH, et al. Hypochlorous acid gel technology-Its impact on post-procedure treatment and scar prevention. *J Cosmet Dermatol*. 2017;16(2):162-167.
35. Toon CD, Lusuku C, Ramamoorthy R, et al. Early versus delayed dressing removal after primary closure of clean and clean-contaminated surgical wounds. *Cochrane Database Syst Rev.* 2015 Sep;(9): CD10259.
36. Downie F, Egdell S, Bielby A, Searle R. Barrier dressings in surgical site infection prevention strategies. *Br J Nurs.* 2010 Nov;19(20):S42-6.
37. Kim JYS, Kozlow JH, Mittal B, et al. Guidelines of care for the management of basal cell carcinoma. *J Am Acad Dermatol.* 2018 Mar;78(3):540-59.
38. Shao K, Taylor L, Miller CJ, et al. The natural evolution of facial surgical scars: a retrospective study of physician-assessed scars using the patient and observer scar assessment scale over two-time points. *Facial Plast Surg Aesthet Med*. 2021 Sept:330-8.
39. Gibbons JA, Smith HL, Kumar SC, et al. Antimicrobial stewardship in the treatment of skin and soft tissue infections. *Am J Infect Control.* 2017 Nov;45(11):1203-07.
40. Williamson DA, Carter GP, Howden BP. Current and emerging topical antibacterials and antiseptics: agents, action, and resistance patterns. *Clin Microbiol Rev.* 2017 Jul;30(3):827-60.
41. Del Rosso JQ, Webster GF, Rosen T, et al. Status Report from the Scientific Panel on Antibiotic Use in Dermatology of the American Acne and Rosacea Society. *J Clin Aesthet Dermatol.* 2016 Apr;9(4):18-24.
42. McNeil JC, Hulten KG, Kaplan SL, Mason EO. Decreased susceptibilities to retapamulin, mupirocin, and chlorhexidine among staphylococcus aureus isolates causing skin and soft tissue infections in otherwise healthy children. *Antimicrob Agents Chemother.* 2014 May;58(5):2878-83.
43. Lim JS, Park HS, Cho S, Yoon HS. Antibiotic susceptibility and treatment response in bacterial skin infection. *Ann Dermatol*. 2018 Apr;30(2):186-91.
44. D'Cunha NM, Peterson GM, Baby KE, Thomas J. Impetigo: a need for new therapies in a world of increasing antimicrobial resistance. *J Clin Pharm Ther.* 2018 Feb;43(1):150-53.
45. Hrubša M, Siatka T, Nejmanová I, et al. Biological Properties of Vitamins of the B-Complex, Part 1: Vitamins B1, B2, B3, and B5. *Nutrients*. 2022 Jan;14(3):484.
46. Baron JM, Glatz M, Proksch E. Optimal Support of Wound Healing: New Insights. *Dermatology.* 2020;236(6):593–600.
47. Proksch E, de Bony R, Trapp S, Boudon S. Topical use of dexpanthenol: a 70th anniversary article. *J Dermatol Treat*. 2017 Dec;28(8):766–773.
48. Li W, Yu Q, Shen Z, et al. Effects of a cream containing madecassoside, 5% panthenol, and copper-zinc-manganese on improving post-laser resurfacing wound healing: A split-face, randomized trial. *Dermatol Ther*. 2020 Jul;33(4):e13533.
49. Bhatia A, Hsu J, Schlessinger T, Weiss R. Optimizing wound healing for cosmetic and medical dermatologic procedures. *Practical Dermatol*. 2018 Mar:42-5.
50. Morales-Burgos A, Loosemore MP, Goldberg LH. Postoperative wound care after dermatologic procedures: a comparison of 2 commonly used petrolatum-based ointments. *J Drugs Dermatol*. 2013 Feb; 12(2):163-164.
51. Trookman NS, Rizer RL, Weber T. Treatment of minor wounds from dermatologic procedures: a comparison of three topical wound care ointments using a laser wound model. *J Am Acad Dermatol.* 2011 Mar;64(Suppl 3):S8-S15.
52. Levender MM, Davis SA, Kwatra SG, et al. Use of topical antibiotics as prophylaxis in clean dermatologic procedures. *J Am Acad Dermatol.* 2012 Mar;66(3):445-451.
53. Jiang Q, Chen J, Tian F, Liu Z. Silicone gel sheeting for treating hypertrophic scars (review). *Cochrane Database of Systematic Reviews*. 2021 Sept;(9).
54. Kammerlander G, Eberlein T, Lantin A, et al. Wet-to-dry phase 2.0. *Wound Med*. 2013 Jul;1:15-15.
55. Gupta A. Classification of wounds and the physiology of wound healing. In: Kumar P, Kothari V, (eds). Wound healing research. Singapore: Springer; 2021 Jul. 3-53.
56. Obagi Z, Damiani G, Grada A, Falanga V. Principles of wound dressings: a review. *Surg Technol Int*. 2019 Nov;35:50–57.
57. Rodrigues M, Kosaric N, Bonham CA, Gurtner GC. Wound healing: a cellular perspective. *Physiol Rev.* 2019 Jan;99(1):665–706.
58. Powers JG, Higham C, Broussard K, Phillips TJ. Wound healing and treating wounds: chronic wound care and management. *J Am Acad Dermatol.* 2016 Apr;74(4):607–625.
59. Jourdan M, Madfes DC, Lima E, et al. Skin care management for medical and aesthetic procedures to prevent scarring. *Clin Cosmet Investig Dermatol.* 2019 Oct;(12):799-804.