Dermabrasion

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Anatomy

The skin is composed of the epidermis, dermis, and subcutaneous tissue. The dermis is further subdivided into the papillary and reticular dermis. To safely perform dermabrasion, a surgeon must know what each layer looks like as it is encountered in the operative field during dermabrasion.

The epidermis is made up of four major strata of replicating epithelial cells. The most superficial layer is the stratum corneum, composed of multiple layers of desiccated cells which have lost their cytoplasmic organelles, and are filled with keratin deposits. The stratum lucidum is a thin, clear layer of cells found just under the stratum corneum. Below this lies the stratum granulosum, so named for the intense stain seen in histologic preparations. The next layer derives the name stratum spinosum from its characteristic spiny cytoplasmic appendages. The base layer, nearest to the dermis is the stratum basale, which is a single layer basement membrane of cells.

The dermis is composed of organized connective tissue in two separate major layers which interdigitate through a system of pegs and ridges. The papillary dermis is the more superficial of the two and is located just below the stratum basale of the epidermis. The papillary dermis has multiple sensory nerve endings and a rich vascular plexus. As the abrasion proceeds through the epidermis, a small amount of diffuse pinpoint bleeding can be observed upon entry into the papillary dermis. The reticular dermis is the lower level of the dermis and is composed of large bundles of collagen, providing the skin its tensile integrity. Upon entering into the depth of the reticular dermis with dermabrasion, the surgeon will notice a relative decrease in pinpoint bleeding, but an increase in a white-colored layer composed of parallel lines of collagen. Dermabrasion is safe to the level of the superficial or mid-reticular dermis, and some have related the topography of this level to a finely woven laparotomy sponge, commonly used in surgery. As the collagen bundles sort into parallel bands, so do many of the blood vessels, thus leaving the pinpoint bleeding behind. If dermabrasion continues beyond this depth into the subcutaneous tissue, scarring is likely. Sebaceous glands and hair follicles are important in the regeneration process of the dermis.

Abstract

For many patients, sun damage, trauma, prior cutaneous carcinomas, and aging have created a less than optimal skin appearance. There are currently multiple forms of ablative therapy to correct such concerns. Dermabrasion is a form of resurfacing that mechanically alters the skin at the level of the dermis, to promote collagen remodeling and re-epithelialization. Facial skin has a rich vascular and adnexal network, allowing the rapid healing of controlled damage because blood, macronutrients, and oxygen are readily available. Sebaceous glands and hair follicles are important in the regeneration process of the dermis. Dermabrasion can be taken down layer by layer to remove the proper level of skin, so that the desired effect is obtained. By completely removing the epidermis and penetrating into the reticular and papillary dermis, controlled damage is obtained and remodeling of the skin’s structural proteins, into a more organized manner, occurs during the healing process. This abrasion technique leads to clinically significant improvements in skin structure, quality, and appearance.

Keywords

► dermabrasion
► ablative resurfacing
► scar revision
► scar
► rhytides

Issue Theme

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Selection and Contraindications

Before initiating any procedures, an accurate history and physical exam should be obtained. The surgeon should ask about previous history of poor scarring and keloids, thyroid disorders, anemia, malnutrition, clotting disorders, use of anticoagulants and nonsteroidal anti-inflammatory drugs (NSAIDs), organ transplants, prolonged use of steroids, chronic leukemia, hepatitis C, human immunodeficiency virus, and previous herpetic outbreaks. Blood can become aerosolized during dermabrasion; therefore, patients with blood-borne pathogens should be excluded from treatment with rotating fraises and brushes.

Dermabrasion can be employed to improve a wide variety of skin anomalies, including acne scars, keloids, traumatic scars, surgical scars, facial rhytides, actinic keratosis, rhinophyma, and tattoos. Although, caution should be employed in dermabrasion of keloids. Accurate assessment of the skin condition is critical to determining the success and utility of dermabrasion. If the skin lesion is located within the papillary or superficial reticular dermis, there is a high likelihood that dermabrasion will be a good therapeutic option. Dermabrasion is optimally appropriate for patients with Fitzpatrick type I or II skin. Patients with Fitzpatrick type III and greater have an increased risk of postprocedure pigment abnormalities, such as hypo- or hyperpigmentation. Four to six weeks of preprocedure 4% hydroquinone, used daily, reduces the risk of hyperpigmentation.

The current or recent use of isotretinoin is an absolute contraindication to dermabrasion, as hypertrophic scarring may occur. Isotretinoin should be discontinued a minimum of 6 months before dermabrasion and other resurfacing techniques. Individuals with a recent history of herpetic outbreak should wait at least 6 to 8 weeks before undergoing dermabrasion. High-dose acyclovir is recommended, starting 2 days before the procedure and continuing for a total of 2 weeks. The timing for postoperative scar dermabrasion remains variable, but usually is accomplished within a 6- to 12-week window of wound formation, when collagen remodeling is at its height.

Patients should be well informed of the risks, benefits, and realistic outcomes of dermabrasion. Re-epithelialization can take 4 to 10 days, depending on the depth. Hyperpigmentation and redness can occasionally persist for 6 weeks or more. Thorough counseling about the procedure is recommended to avoid postoperative patient confusion and dissatisfaction.

CO₂ versus Dermabrasion

Small observational studies propose that fractionated CO₂ laser has less erythema and edema than dermabrasion; however, the final outcomes were equivalent. Jared Christophel et al studied six patients using standard dermabrasion diamond fraise technique versus a fractionated CO₂ laser with four passes over the scars of Mohs patients. Mandy commented on the technique as well, stating her experience in both realms, and confirmed Jared Christophel et al results.

Similar long-term results have been reported from ablative CO₂ resurfacing versus dermabrasion as well. Yet, ablative CO₂ resurfacing was associated with increased crusting and less rapid epithelialization than dermabrasion in a small study done by Holmkvist and Rogers.

High-energy, pulsed CO₂ also shows comparable results to dermabrasion. Nehal et al looked at four patients to evaluate differences. The study demonstrated that the erythema was comparable in both groups; however, crusting was worse in the immediate postoperative period in the dermabrasion areas. Both techniques demonstrated statistically significant differences and improvement in scar cosmesis and texture; however, there was no statistical difference between the two.

Progression of a patient with several basal cell carcinomas can be observed in Figs. 1 to 4, showing repaired basal cell carcinoma of the left face and revision Mohs reconstruction of the left nasal sidewall and ala. Dermabrasion was completed in the office 6 weeks after her Mohs closure and

Fig. 1 (A–C) Postoperative Mohs resection.
revision. ► Fig. 1 demonstrates the defects after the Mohs resection. ► Fig. 2 shows the (A) preoperative and (B) postoperative appearance after reconstruction and dermabrasion on frontal view. ► Fig. 3 shows the (A) preoperative and (B) postoperative appearance after reconstruction and dermabrasion on lateral view. ► Fig. 4 shows the (A) preoperative and (B) postoperative appearance after reconstruction and dermabrasion on basal view.

Microdermabrasion

Microdermabrasion is a nonsurgical, office-based procedure used to exfoliate the skin. Superficial ablation of the stratum corneum is achieved by microdermabrasion to reveal new and healthy underlying skin. A session takes approximately 30 minutes in the office and is associated with no downtime. It is best for patients hoping to cosmetically improve the tone and texture of minimally photoaged skin. The efficacy of microdermabrasion to treat scars is much less than that of dermabrasion because microdermabrasion only penetrates the stratum corneum. Thus, it is only beneficial for the most superficial of facial rhytids or scars. The use of isotretinoin within a year of treatment, prior radiation therapy to the affected area, and patients with hypertrophic scarring are poor candidates for both dermabrasion and microdermabrasion. Microdermabrasion decreases skin sebum content, increases epidermal concentration of ceramide, decreases epidermal water loss, and enhances texture of the skin.

Preparation

Some patients may be placed on topical tretinoin and or hydroquinone 2 to 6 weeks before therapy. Other surgeons prefer a combination of hydroquinone, mild topical steroid, and retinoic acid in a cream form 2 to 6 weeks before dermabrasion to reduce postoperative hyperpigmentation. Sun exposure should be kept to a minimum for 2 months before and after the procedure to avoid complications.

Regional dermabrasion can be achieved with the use of nerve blocks. If full facial dermabrasion is to be performed, intravenous sedation or general anesthesia is an easy option for both the patient and the surgeon. However, others have proposed tumescent anesthesia to avoid sedatives and general anesthetics. A comprehensive sequence for providing facial anesthesia in this manner is best described by Hanke. Before the procedure povidone-iodine 10% or other ophthalmologically safe surgical scrubs should be used to prepare the skin surface that will be dermabraded. Betadine is easy to use, and because of its color, can serve as a map for areas that have yet to be abraded when large areas are involved. Hats, masks, gloves, and other standard Occupational Safety and Health Administration (OSHA) precautions are mandatory.

Instrumentation and Surgical Technique

Usually a diamond fraise or rotating wire brush is employed on a handheld drill device. Yet, some use sterilized sand paper
Dermabrasion

with excellent results. Appropriate technique is nonetheless paramount in all ablative resurfacing techniques, as misuse can cause further scarring and infection. Most surgeons commonly employ an electric-powered, handheld device with a rotating tip that will accept multiple fraises or wire brushes. Many devices have the ability to adjust speeds of rotation from 5,000 to 85,000 rpm. Most machines can rotate the fraise clockwise or counterclockwise. The faster the rate of spin, the more powerful the device becomes, decreasing the need for pressure, and increasing the risk of accidental depth penetration and thermal injury. Thus, speed and pressure of the device should be taken into account and adjusted separately.

To maintain consistency and control over the procedure, the skin should be drawn taught, so that the fraise cannot skip or rip loose skin. Refrigerant sprays can be used for both pain modulation and to keep the skin cool during dermabrasion to prevent secondary thermal injury. The skin is placed on stretch by the surgeon and the assistant, to maintain tightness of the area being abraded. When a new area is to be abraded, the device is halted, and tension is readjusted to the new region before proceeding. It is wise to avoid gauze and other cloth in the field, as these can become easily wrapped around the circulating fraise or brush and cause injury to the patient or the treatment team.

The diamond fraise is a diamond studded tip that can be found in a variety of shapes, sizes, and grit. Shapes include wheel, cylinder, cone, bullet, pear, and more. Fraise grit can vary from fine to coarse diamond. Larger burs with greater grit are more aggressive and can be used for full face dermabrasion and deeper scars. The diamond fraise has a high contact surface area with the skin, and thus the higher the rotational speed, the greater the thermal and frictional injury that can occur. Manual dermabrasion with sand paper and other nonmechanical devices has shown no statistical differences in scar revision cosmesis and texture over mechanical dermabrasion machines.

The rotary wire brush is another instrument employed by many. The tip consists of a cylinder with wires protruding 2 to 3 mm from the central core. The wire brushes also come in a variety of sizes, shapes, and coarseness. The wire brush produces microlacerations to the skin instead of the frictional injury caused by the fraise. These wire brushes have the ability to cut through skin with even mild pressure; thus, rotation rates of greater than 25,000 rpm are not recommended.

No matter which attachment is used, proper manipulation, pressure, and control are imperative to prevent unnecessary injury. Multiple techniques have been described, and each surgeon must find the practices that are best suited for each situation. The dermabrader can be gripped like a pencil, or the device can be gripped like the handle of a spatula. The latter of the two grips affords better control and minimizes the risk of ricochet of the device during treatment. Both grips allow the instrument to be handled accurately, and the attachments to be beveled when necessary. Occasionally, the pencil grip can lead to inadvertent edge beveling, reducing the surface area of the device in contact with the skin, and increasing the sharp cutting edge, which can lead to skin injury. There are multiple working patterns that can be used during the dermabrasion process across the treatment region. Some use opposing right angles, others back and forth, left to right, or superior to inferior. Care is always taken around loose, nontense structures, such as eyelids, lips, and the ala. The temple areas, likewise, have fewer follicular units and are more susceptible to scarring if too much pressure and depth of penetration are applied.

As with most chemical peels, dermabrasion is performed best by facial subunits or sections. Starting with the outermost areas and working inward allows the surgeon to work in areas where gravity keeps blood from running into and obscuring the field. Dabbing at bleeding areas is permissible, but be leery of gauze near the rotating attachment, as it is easily caught up in the attachment and can cause damage to the patient or surgical team. Feathering to avoid lines of demarcation is important; the dermabrasion should be taken to the hairline and rolling slightly beneath the chin and edge of mandible. Blending at the edges with a lighter touch feathers the edges and makes them less noticeable. This feathering technique should be used at any transition, such as from the face to neck or the neck to the chest.

Diffuse pinpoint bleeding signals entry into the papillary dermis. A yellow chamois color indicates the reticular dermis, with the superficial layer characterized by parallel oriented strands within the dermis. The deeper reticular dermis is marked by frayed, white strands. Entry into the deep reticular dermis should be avoided, as it is associated with scarring.

Postoperative Considerations

In truth, there are multiple ways to treat the face during the re-epithelialization period. Some common products include petroleum-based or nonpetroleum-based creams and emollients, petroleum-based and nonpetroleum-based antibiotics, hydrating creams, occlusive dressings, and biologic dressings. Surgeons must be careful with products that contain neomycin, as contact dermatitis can occur, leading to confusion between allergic reaction, superinfection, and viral infection. Cleaning and reaplication of ointments should be done two to four times daily. One of the most important aspects is keeping the area well hydrated to allow proper re-epithelialization. Erythema, edema, and some crusting are to be expected, but epithelialization should be well on its path within 10 days. Sun avoidance and frequent application of sunscreen are paramount following re-epithelialization. Hyperpigmentation and hypopigmentation can occur if avoidance of UV radiation is not monitored.

Skin Changes

Evaluating the success of dermabrasion is often difficult because the measurement criteria are subjective. One study evaluated the efficacy of dermabrasion with the diamond fraise and wire brush and found that both techniques led to statistically significant moderate to marked improvements in the appearance of photoaged skin at both 3 and 12 weeks. There was no statistical difference between the diamond
fraise and the wire brush technique. Other studies have shown similar results between the diamond fraise and the brush, and the diamond fraise and sterile sanding paper. Multiple studies have supported the fact that dermabrasion leads to clinically and statistically significant improvements in lentigines, actinic keratosis, and rhytides.

The histologic and clinical improvements following dermabrasion occur because mechanical resurfacing induces collagen remodeling and changes in other proteins in the dermis. There is an increase in the organization and amount of collagen infrastructure, leading to both histologic and clinical improvements.

### Adverse Events

In the hands of a skilled surgeon, adverse events and poor outcomes are rare. However, proper patient selection and preparation are keys to good clinical results. Skin can be streaked, hyperemic, and blotchy if pressure is not constant across the areas treated. Hyperpigmentation and milia are two other common postoperative occurrences. Milia can be treated with extraction, microdermabrasion, abrasive soaps, and retinoids after re-epithelialization. Hyperpigmentation usually is self-limited, but can be reduced with hydroquinone, starting 4 to 6 weeks after dermabrasion if necessary. If the surgeon should encounter subcutaneous fat during the procedure, scarring and infection are likely; therefore, the dermis must be reapposed with sutures, and the area must be closely monitored with follow-up.

Postoperative infections are usually associated with Staphylococcus aureus, herpes simplex virus (HSV), and Candida. Staphylococcal infections usually present by the third postoperative day with honey-crusted lesions, edema, erythema, and occasional fevers. HSV infection is recognized by pain out of the ordinary for the procedure, usually within 72 hours of the dermabrasion. The patient usually has a known risk of HSV infections and can be treated with acyclovir or valacyclovir, which is advocated for a minimal of 10 days postoperatively. Conventional diamond fraise vs manual spot dermabrasion with energy pulsed carbon dioxide laser. Arch Dermatol 2000;136(6):725–731


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