Conventional Diamond Fraise vs Manual Spot Dermabration With Drywall Sanding Screen for Scars From Skin Cancer Surgery

Montgomery Gillard, MD; Timothy S. Wang, MD; Charles M. Boyd, MD; Rodney L. Dunn, MS; Darrell J. Fader, MD; Timothy M. Johnson, MD

Objective: To directly compare cosmetic improvement and postoperative sequelae resulting from dermabrasion of surgical scars with conventional motor-powered diamond fraise vs manual dermabrasion with medium-grade drywall sanding screen.

Design: Patients were randomly assigned to receive treatment with conventional diamond fraise dermabrasion to one half of the scar and manual dermabrasion with a drywall sanding screen to the other half in a prospective, comparative clinical study. Blinded observers assessed clinical variables during a 6-month follow-up period.

Setting: University hospital/cancer center–based cutaneous surgery unit.

Patients: Twenty-one healthy volunteers, Fitzpatrick skin type I to III, with contour irregularities resulting from granulation (7 patients) or reconstruction (14 patients) after skin cancer excision.

Interventions: One half of the patient’s scar was treated with motor-powered diamond fraise dermabrasion and the other half was treated with manual dermabrasion with medium-grade drywall sanding screen.

Main Outcome Measures: Correction of contour, scarline visibility, time to reepithelialization, presence or absence of milia, degree of postoperative erythema, hypertrophic scarring, patients’ subjective reports of postoperative pain, and presence of pigmentary changes were observed for both methods. Standardized scoring systems were used to quantify outcome measures.

Results: According to the standardized scoring systems, no differences were found between the 2 methods at any point. In addition, no significant differences were found between the methods for any measure at any of the time points.

Conclusion: Both dermabrasion techniques are equally effective in improving the cosmetic appearance of surgical scars.

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Dermabrasion is an effective surgical procedure for the treatment of a variety of dermatologic disorders, including photodamage, acne scarring, and scarring from surgery or trauma. Spot dermabrasion has been shown to improve the appearance of surgical scars.1-6 Dermabrasion is usually performed at 6 to 12 weeks after a reconstructive procedure. Yarborough2 first reported the use of dermabrasion during the early postoperative period, 4 to 8 weeks, to improve scars.

Conventional dermabrasion uses either a diamond fraise (DF) or a wire brush as a cutting tool powered by a handheld motor rotating at 20,000 rpm. Many authors have reported excellent results achieved with this device.1-6 The disadvantages of the powered tool include aerosolizing of infectious particles; blood splatter; the need for protective clothing; risk of lip, eyelids, hair, or gauze being caught in the instrument; and the added cost of the power instrument. Several authors have reported manual use of abrading devices for dermabrasion, including wire brush, DF, sandpaper, Bovie scratch pads, abrasive cloth, and drywall or plaster sanding screen (SS).7-10 These instruments are used manually in a back-and-forth or circular motion.

The use of sandpaper for dermabrasion was first described by plastic surgeon Iverson in 1947.11 Zisser et al12 reported on the benefits and advantages of this technique compared with conventional dermabrasion by using a simple and inexpensive device, drywall or plaster SS, medium grade (3M Corp, St Paul, Minn) wrapped around the barrel of a 3-ml syringe (Figure 1 and Figure 2).12

A controlled comparison between conventional motor-powered and manual dermabrasion has not been previously performed, to our knowledge. Our controlled study was designed to directly compare spot dermabrasion using conven-
PATIENTS AND METHODS

STUDY DESIGN

The primary focus of this comparison study was to determine whether manual dermabrasion using a medium-grade drywall SS is as effective as the motor-powered DF dermabrader in treating surgical scars. Postoperative sequelae between the 2 dermabrasion techniques were also examined. The study was performed at the Cutaneous Surgery and Oncology Unit at the University of Michigan Health System, Ann Arbor. The study protocol was reviewed and approved by both the University of Michigan Comprehensive Cancer Center Protocol Review Committee and the Institutional Review Board of the University of Michigan Medical School.

PATIENTS

Twenty-one patients aged 34 to 86 years were initially enrolled in the study. Nine (43%) were men and 12 (57%) were women. Eighteen patients successfully completed all follow-up visits. Data were complete for all 21 patients at 1 and 4 weeks after dermabrasion. One missed a visit at 2 weeks, 2 at 3 weeks, 2 at 3 months, and 3 at 6 months. All patients were included in the comparison analysis for the time points they completed. All scars were on the face, with 18 on the nose, 1 on the forehead, 1 on the chin, and 1 on the upper lid. Fourteen patients had soft-tissue reconstruction (8 full-thickness grafts, 3 complex closures, and 3 flap closures) after Mohs excision of a skin cancer 6 to 12 weeks previously. Seven patients had wounds that had healed by secondary intention 4 to 32 weeks previously.

Inclusion criteria were ages from 20 to 90 years, willingness and ability to comply with the follow-up interval requirements, and scarring after skin cancer surgery. Exclusion criteria included significant medical history or concurrent illness that, in our judgment, was deemed unstable or not safe for the patient's participation; unwillingness to follow medical instructions and/or comply with the interval postoperative visits; and history of abuse of alcohol or other drugs or intellectual or emotional problems that might limit compliance or requirements for informed consent. An additional exclusion criterion was a history of blood-borne infectious disease such as human immunodeficiency virus, hepatitis B, or hepatitis C infection, which might preclude the use of dermabrasion with the DF. All patients who met the inclusion and exclusion criteria were enrolled in the study after they were informed of the investigational nature of this research study and read and signed a statement of informed consent before participation.

DERMABRASION PROCEDURES

Surgical scars were delineated and divided in halves, either patient's left and right or inferior and superior, depending on the type of scar and its orientation. The right and left or superior and inferior halves of the scars were randomly assigned to receive 1 of the 2 dermabrasion techniques. An instrument legend was completed and was placed in an envelope in the patient's study chart along with the randomization assignment. A team of 4 surgeons (T.S.W., C.M.B., D.J.F., and T.M.J.), using uniform techniques, performed all procedures. After the scar was divided into halves, the area to be dermabraded was outlined by means of a black surgical marking pen (VWR International, West Chester, Pa). When appropriate, entire cosmetic units were abraded on each half.

The area to be dermabraded was anesthetized with 1% buffered lidocaine with epinephrine 1:400,000. The skin was prepared with chlorhexidine gluconate and isonicotinic sodium chloride solution wash and draped with surgical towels. Patients underwent conventional dermabrasion with

RESULTS

For all 21 cases accrued to this study, there were no differences between techniques according to the standardized scoring system developed before study accrual and described in Table 1. Table 2 shows the actual number of differences between the 2 groups, with differences on an absolute scale. For example, if a case had an erythema score of 1 on the DF side and 2 on the SS side, they would be marked as being different (Table 2), even though the standardized scoring system required a difference of at least 2 for that measure (Table 1). If no actual difference was found between these 2 techniques, a 0 was recorded.

Most of the cases had exactly the same scores for both techniques at every time point (Table 2). For correction of contour, infection, and hypertrophic scarring, no differences were found for any case at any time point. The number of milia was equal for 19 of 21 cases at week 1. At week 1, 1 patient had 5 more milia on the SS half, while another had 1 more on the DF half. In 1 case at month 3, a difference in hypopigmentation was present on the SS half but absent on the DF half. However, no differences were observed at 6 months for any case. Three patients had mild pain on the SS side and no pain on the DF side at week 1 (2 cases) and week 4 (1 case), with no differences at weeks 2 and 3. Scar-line visibility was greater in 1 patient on the DF side at week 2, on 2 DF sides and 1 SS side at 6 months, and on 1 DF side and 1 SS side at week 3 and month 3. No differences in scar-line visibility were noted at weeks 1 and 4. Erythema was greater in 1 case on the DF side at weeks 2 and 4, with greater erythema in 2 cases on the DF side at week 3. No erythema differences were noted at months 3 and 6. The percentage of reepithelialization was greater in 1 more case on the DF side in weeks 1 and 2. None of the differences for the healing measures were statistically significant at any time point (all P>.57 except one P=.16).

COMMENT

Granulation and/or reconstructive surgery after skin cancer excision may result in prominent incision lines or con-
a motor-powered handheld abrader with a DF cutting tool to one half of their scar and manual dermabrasion with the drywall-plaster SS, medium grade, to the other half of the scar (Figure 3). Diamond fraise dermabrasion was performed with a motor-driven 17 × 8-mm or 17 × 4-mm, cylinder-shaped coarse DF (Robbins Instruments, Inc, Chatham, NJ). Cryogen spray was not used. The other half was manually dermabraded with the drywall-plaster, medium grade (3M Corp), wrapped firmly around the barrel of a 3-ml syringe as described by Zisser et al.12 Dermabrasion was performed to complete contour correction. Hemostasis was achieved with pressure that was followed by application of bacitracin ointment and a nonstick pressure dressing.

All patients followed the same preprinted postoperative care instructions, which consisted of cleaning the area with soap and water followed by application of bacitracin ointment for 3 days, followed by petroleum jelly once to twice daily. After reepithelialization, the patients were encouraged to apply SPF 15 sunscreen and avoid unnecessary sun exposure (Figure 4).

OUTCOME MEASURES

The patients were monitored for 6 months after dermabrasion: 1 week, 2 weeks, 3 weeks, 4 weeks (±2 days), and 3 and 6 months (±14 days). Each side of the dermabraded scar was evaluated independently in a blinded fashion by a different physician from the one performing the dermabrasion. Outcome measures were evaluated by physical examination of the abraded site and not from photographs. At week 1, 2, 3, and 4 visits, posttreatment scars were assessed for (1) percentage of skin reepithelialization (25%, 50%, 75%, or 100%); (2) skin erythema according to a 0-to-4 standardized color scale; (3) presence or absence of milia (if present, actual count was recorded); (4) scar-line visibility (one side more visible than the other or no difference); (5) correction of contour (unchanged, partial, or complete); (6) presence or absence of infection; (7) patient's self-reported pain score (absent, mild, moderate, or severe); and (8) presence or absence of hypertrophic scarring. At the 3- and 6-month follow-up visits, patients were examined for (1) erythema, by means of the same standardized color scale; (2) scar-line visibility; (3) correction of contour; (4) presence or absence of hypertrophic scarring; and (5) presence of hypopigmented or hypopigmentary changes. Outcome measures were scored and recorded.

STATISTICAL METHODS

The 2 techniques were compared by means of a standardized scoring scheme that incorporated information on each healing measure. Table 1 shows the amount of difference between the 2 halves of the scar that would be counted as “different” for the purpose of creating the standardized measure.

At 1, 2, 3, and 4 weeks, the 2 techniques were considered to have differing efficacy if 3 or more of the 8 end points measured were considered different (Table 1). At the 3-month and 6-month time points, the techniques were considered to have differing efficacy if 2 or more of the 5 end points measured at those times were considered different. The percentage of cases for which the techniques led to different results were reported, along with an exact binomial confidence interval.

To further explore the differences, each healing measure at each time point was compared by means of actual number differences on an absolute scale between the 2 techniques with the use of a contingency table (Table 2). Bowker test of symmetry was then used to test for differences between the techniques. A P value of <.05 was considered statistically significant, and SAS software (SAS Institute Inc, Cary, NC) was used for all analyses.

formation, pigmentation changes, pain, infection, or cosmetic result. Previous studies have shown that both the DF and SS produce few, if any, significant postoperative sequelae such as hypertrophic scarring, infection, or postinflammatory hyperpigmentation.12,15 Katz and Oca15 noted that several scars did manifest mild postoperative hypopigmentation with the use of conventional dermabrasion.13 Cryogen spray was used in that study.

One potential criticism of our study, as well as other split-scar models, is the accuracy of grading with respect to area treated.13 No physical measurements were taken to exactly delineate the area treated by the 2 instruments for the postoperative grader. Therefore, overlap in grading the 2 areas could have occurred. However, the 2 methods did not demonstrate any significant differences in cosmetic result or postoperative sequelae. The intent of the study was to show that the 2 techniques are equal in outcome measures.

Manual dermabrasion with the sanding screen offers several advantages over motorized dermabrasion with either DF or wire brush, including cost and safety. The equipment has minimal cost, requires no maintenance, is easy to prepare, and is disposable. The cost of the screen and syringe is $0.61. The cost of the motor-driven derm-
abrader is $1365 for initial purchase. The cost of a single DF is $32. In addition, the fraises must be cleaned and gas sterilized, another added cost. Additional costs for conventional dermabrasion include face shields and extensive draping for surgeon and patient. There is no appreciable risk of injury from equipment getting caught on gauze, eyelid, or lip with the SS. The technique is easy to learn, and Ss, as well as sandpaper, come in various grades, allowing the beginner to use finer grades.

One of the most compelling advantages of manual SS dermabrasion is the absence of aerosolized particles and blood splatter that are generated by motor-powered dermabrasion. The father of motor-powered dermabrasion, the late New York City dermatologist Abner Kurtin, MD, initially performed dermabrasion while wearing a raincoat. He also described having to wash off the blood and debris from his face after each case. Motor-powered dermabrasion produces a considerable amount of airborne blood and skin debris that is potentially hazardous to operating room personnel and requires specialized barrier methods. Furthermore, evidence exists that dermabrasion can generate aerosolized particles that may be transferred large distances and may still linger hours after barrier protection devices have been removed. It is uncertain whether these particles can transmit infectious diseases such as hepatitis or human immunodeficiency virus, but concern regarding this possibility has been reported. Recently, a hydration-suction apparatus was described to reduce this risk; however, this again increases costs.

One disadvantage of manual dermabrasion is greater difficulty in concave areas such as the alar groove and nasolabial fold. Insertion of cotton swabs in the nasal vestibule with outward pressure facilitates manual dermabra-
tion in the alar groove. Still, the surgeons in our study noted that motorized dermabrasion with a pear-shaped fraise was easier. In addition, the motorized unit was faster than manual dermabrasion. However, the difference in procedure time for spot procedures is minimal (a few minutes).

Manual dermabrasion has been reported with the use of a variety of instruments, including a variety of types of sandpaper, Bovie scratch pads, DF, wire brush, and abrasive cloth, in addition to the drywall SS. The SS is available from a number of manufacturers. It can be cut into an appropriate size and flash autoclaved and is then ready for single use. The drywall sanding screen has a distinct advantage over sandpaper. Its mesh porosity prevents clogging with blood and skin debris and, to date, with many hundreds of cases reported, no silicone granulomas have been noted.

The mechanism responsible for clinical improvement of scars after dermabrasion is unknown. Yarborough2 proposed that dermabrasion restructures and lays collagen parallel to the lines of tension to smooth contour irregularities and eliminates the epidermal component by upward and horizontal migration of epithelial cells from viable adnexal structures. Nelson et al22 demonstrated an increase in collagen type I synthesis after superficial dermabrasion for photaged skin. Harmon et al23 examined the ultrastructural and cell-cell and cell-matrix interactions after conventional DF dermabrasion. They reported that DF dermabrasion resulted in an increase in collagen bundle density and size with unidirectional orientation parallel to the epidermal surface when examined ultrastructurally. They also observed that dermabrasion alters cell-cell and cell-matrix interactions between the epidermis and the dermis. This was demonstrated by an up-regulation of tenasin (an extracellular matrix glycoprotein) expression throughout the papillary dermis and of αvβ3 integrin (a transmembrane adhesion receptor) subunit on the keratinocytes throughout the stratum spinosum epidermides after dermabrasion. The alteration in tenasin expression may promote both epithelial cell migration along the basement membrane zone and fibroblast movement across scar boundaries. The postdermabrasion alteration of integrin expression coincides with an increase in cell migration and may promote reepithelialization across the scar, which leads to a more blended epidermal contour.

In conclusion, dermabrasion with manual and motorized techniques is equally effective in improving the cosmetic appearance of surgical scars. Manual dermabrasion with the medium-grade drywall SS offers distinct advantages over conventional motor-powered dermabrasion with the DF. These advantages include lower cost, ease of use, and absence of blood splatter or aerosolized particles.

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Reprints not available from the authors.

REFERENCES


Table 2. Actual Number Differences Between Techniques for Each Healing Measure According to an Absolute Scale in 21 Cases*

<table>
<thead>
<tr>
<th>Healing Variable</th>
<th>1 wk</th>
<th>2 wk</th>
<th>3 wk</th>
<th>4 wk</th>
<th>3 mo</th>
<th>6 mo</th>
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<tbody>
<tr>
<td>Percentage of reepithelialization</td>
<td>4 DF</td>
<td>1 DF</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Erythema scale</td>
<td>1 DF</td>
<td>1 SS</td>
<td>1 DF</td>
<td>2 DF</td>
<td>1 DF</td>
<td>0</td>
</tr>
<tr>
<td>No. of milia</td>
<td>1 DF</td>
<td>1 SS</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Correction of contour</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Infection</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Patient’s pain score</td>
<td>2 SS</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hypertrophic scarring</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Scar-line visibility</td>
<td>0</td>
<td>1 DF</td>
<td>1 DF</td>
<td>1 SS</td>
<td>0</td>
<td>1 SS</td>
</tr>
<tr>
<td>Pigmentation changes</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

*Zero represents no cases having any absolute differences, while a number represents the number of cases in a particular group that had a higher score (eg, 4 diamond fraise [DF] means that 4 cases had a higher score on the DF side than on the sanding screen [SS] side). Ellipses indicate not measured at these time points.