Antibacterial Ointments Versus Petrolatum-Based Ointments in Clean Wounds for Wound Healing

Kate Muirhead

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Antibacterial Ointments Versus Petrolatum-Based Ointments in Clean Wounds for Wound Healing

Abstract

Background: Clean wounds are a frequent occurrence in the medical field and medical providers provide varied advice for wound care. Topical antibacterial ointments are commonly used to facilitate wound healing in patients with these types of wounds. Topical antibacterial ointments have been shown to cause allergic contact dermatitis, may cause an increase in antibiotic resistance, and may be equally efficacious when compared to petrolatum-based ointments for healing clean wounds.

Method: An exhaustive search of available medical literature was performed using Medline, CINHAL, and Cochrane databases. Search terms were: antibacterial agents, wound healing, and petrolatum. Articles were limited to humans and English language only. Studies were excluded if wounds were not clean, the study was not performed in a double blinded fashion, or if the study was not performed in the last 20 years.

Results: Four studies were found through the literature search after inclusion and exclusion criteria were met. All studies found that petrolatum-based ointments were as efficacious in the healing of clean wounds as antibacterial agents. Two of the studies had occurrences of allergic contact dermatitis.

Conclusion: Current studies suggest that petrolatum-based ointments are equally effective in healing clean wounds when compared to antibiotic based ointments. Using an antibiotic ointment does not decrease the rate of infection and puts patients at risk for allergic contact dermatitis and antibiotic resistance.

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First Advisor
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antibacterial agents, petrolatum, wound healing

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Antibacterial Ointments Versus Petrolatum-Based Ointments in Clean Wounds for Wound Healing

Kate Muirhead

A Clinical Graduate Project Submitted to the Faculty of the
School of Physician Assistant Studies
Pacific University
Hillsboro, OR
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Clinical Graduate Project Coordinator: Annjanette Sommers, PA-C, MS
Biography

[Information redacted for privacy]
Abstract

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Acknowledgements

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List of Abbreviations

PBO..............................................................Petrolatum Based Ointments
ABO..................................................................Antibacterial Ointments
ACD..................................................................Allergic Contact Dermatitis
AHO...............................................................Aquaphor Healing Ointment
TEWL..............................................................Transepidermal Water Loss
Antibacterial Ointment Versus Petrolatum-Based Ointment in Clean Wounds for Wound Healing

BACKGROUND

The skin is often the first line of defense when protecting from outside pathogens. It is the barrier separating our delicate internal environment from the outside world, and is the largest organ in the human body. When there is a deficit in the skin it is important to optimally repair it so that the skin can return to normal functions like helping to regulate body temperature and providing sensation.

Wound care is a simple, but important aspect of medicine. Without proper treatment wounds can develop infections, have delayed healing, or result in disfiguring scars. Dermatologists as well as general and family practice providers perform more procedures that result in clean wounds and necessitate wound care when compared to all other specialties.¹ Common procedures that produce clean wounds include skin biopsies, removal of benign skin lesions, phototherapy, and diagnostic procedures.

Choice of treatment to facilitate wound healing is up to the provider’s discretion. Selections include the choice between topical antibiotic ointments, petrolatum-based ointments, or leaving the wound to heal without topical treatment. Dermatologists often make these decisions as they perform the most cutaneous procedures,¹ and use more topical antibiotics than all other medical specialties.²

Guidelines for topical wound therapy address the two main principles of wound healing: remove anything from the wound that will hinder its repair, and maintain an environment conducive to skin’s regeneration. Included in sustaining a positive healing environment is preserving a moist and insulated wound surface. This result can be
obtained by using an ointment. Some clinicians choose to use an antibacterial ointment such as bacitracin or Neosporin, or a petrolatum-based ointment such as Aquaphor to provide a semi-occlusive barrier. Providers often choose to use antibacterial ointments to help facilitate healing with the belief that these medications will decrease rates of infection. Recent studies have shown that use of antibacterial ointments in the ambulatory surgical population does not decrease the risk of infection.

While antibiotic ointments do create a barrier for the wound, they also come with the possibility of side effects. Antibacterial ointments have been shown to cause allergic contact dermatitis as well as antibiotic resistance. Petrolatum-based ointments also provide a semi-occlusive barrier to the wound, but are not associated with these adverse events. A recent study looking at the irritation potential of common topical ointments on normal and compromised skin, found that the petrolatum-based ointment Aquaphor had the lowest irritancy potential.

Antibiotic resistance is an important issue to consider when selecting an ointment to use on a wound. Cases of MRSA resistant to mupirocin have been reported, as well as instances of staphylococci and gram-negative bacilli resistance to neomycin. Until recently these bacteria were susceptible to the mentioned topical antibiotic. Occurrences like these lend themselves to the idea of a more judicious use of antibiotics.

Allergic contact dermatitis is a common issue, with 10% of the general patch tested population suffering an allergic reaction to neomycin, which is found in Neosporin, and 9.2% an allergic reaction to bacitracin. The American Contact Dermatitis Society named Neosporin the “allergen of the year” in 2010, and Bacitracin received the “award” in 2003. The society gives out this designation annually to bring awareness to allergens
that commonly cause cases of dermatitis. The cutaneous reaction to antibiotic ointment in a susceptible individual is erythematous and pruritic lesions that may be painful. Not only is this uncomfortable for the patient, but it inhibits proper healing of the wound.

The purpose of this systematic review is to gather information from current and past studies to determine if petrolatum-based ointments are equally effective in promoting wound healing in clean wounds when compared to antibacterial ointments.

METHODS

An exhaustive search of medical literature was performed utilizing the databases for Medline, CINAHL and Cochrane. The terms used during the search were: antibacterial agents, wound healing, and petrolatum. Use of common antibacterial names, bacitracin and Neosporin, as well as the term Aquaphor, a common petrolatum-based ointment, were also used to ensure a comprehensive search, but these added terms did not yield any additional usable results.

Limits imposed in the search were that the articles be in English and the studies were completed on human subjects. The studies were to only include patients who had clean wounds as a result of a sterile procedure by a medical professional. Also part of the inclusion criteria was that the articles compare an antibacterial agent and a petrolatum-based ointment.

The resulting articles were further sorted by exclusionary criteria. Studies were excluded if they were not randomized controlled trials, if wounds were not considered clean, or if the study was not performed in the last 20 years.

The studies were then critically appraised using GRADE criteria to assess validity and bias. Based on this evaluation the studies were ranked as high, medium, low or very
RESULTS

Four articles\textsuperscript{10-13} were found during the search for inclusion in this review. All of the study designs were double-blinded randomized control trials. Each study stated that antibacterial ointments (ABO) and petrolatum-based ointments (PBO) were equally effective in promoting wound healing. They observed an equally low incidence of infection with both ABO and PBO. Patients in all studies were initially screened and those who had known allergies to the materials used were not enrolled in the study. There were few reports of adverse events. Results are summarized in Table II.

Smack et al

Smack et al\textsuperscript{10} was a double-blinded prospective randomized control trial organized to determine the effects of white petrolatum compared to bacitracin on wound infection incidence, allergic contact dermatitis, and healing characteristics. The trial was completed over a nine-month period in 1993 to 1994, and all patients who underwent a surgical procedure during that time were included in the study if they met inclusion and exclusion criteria. The setting was a general outpatient dermatology clinic and a tertiary referral advanced surgical procedure clinic at Walter Reed Army Medical Center in Washington, DC. Patients were excluded if they had a known allergy to any of the materials used in the study. All patients were at least 18 years old.\textsuperscript{10}

Dermatological procedures included in this study were shave biopsy, punch biopsy, electrodessication & curettage, excision, Mohs surgery, and dermabrasion. There were a total of 922 patients in the trial and 1249 wounds, as some patients had more than one procedure at a time. Patients were randomized by computer to apply either white
petrolatum or bacitracin to wounds, and wounds included various skin surfaces. Patients returned for follow up post surgery day 1, 7, or 28 depending on their procedure, but all were seen at day 28. During the course of the study 38 patients were lost to follow-up with no explanation. At follow up wounds were assessed for evidence of infection, ACD, and healing characteristics using the absence or presence of purulent material, erythema, tenderness, and pruritis as measurements. If a patient had marked pruritis, patch testing was performed to verify ACD. If patients had pus, erythema, or tenderness present, a culture of the wound was taken and patients were started on oral antibiotics. If patients listed one of those symptoms, and had a positive culture with pathological bacteria, infection was declared. Wound healing was measured by the clinicians, and was noted as wound open, wound closed, scab/eschar present, or mature scar present. Ointment jars were collected at day 28 and were weighed to determine amount used, as a method of measuring patient compliance.

Results of the data collected showed no clinically significant differences in wound healing when using white petrolatum compared to bacitracin during days 1, 7, and 28. There were zero incidences of allergic skin reactions in the white petrolatum group, and 4 patients who developed ACD in the bacitracin group. They also examined infection rate and found an infection rate of 2.0% with the white petrolatum participants, and 0.9% in the bacitracin group (95% CI for difference, -0.4% to 2.7%). The important outcome of weighing the ointment containers was that there was no difference in the amount of topical medication used between the ABO and PBO groups. The cost of ointments was compared, with Garamycin being the most expensive ($16.42/15g) followed by Bactroban ($14.50/15g), Polysporin and Neosporin (both $3.42/15g), Bacitracin
($1.50/15g), and white petrolatum was found to be the least expensive ($0.30/15g).\textsuperscript{10}

**Trookman et al**

Trookman et al\textsuperscript{11} was a double-blind randomized control trial which sought to determine if antibiotic ointments were necessary for the treatment of clean surgical wounds. They recognized possible complications of antibacterial agents including allergic contact dermatitis and antibiotic resistance and proposed that a PBO may be a reasonable substitute. The study setting was Colorado Springs Dermatology Clinic, which is an outpatient facility.\textsuperscript{11}

Twenty participants from 20-50 years old, with Fitzpatrick skin types I, II, and III were included in the study. Patients with diseases that would inhibit wound healing, might impair evaluations, or increase the participant’s health risk, in addition to those with known allergies, were excluded. An erbium/carbon dioxide laser was used to make 4 uniform circular wounds, 5mm in diameter, in the volar surface of the forearm in each participant. Depth of the wounds was to the reticular dermis, which is comparable to the depth of common procedures like electrodessecations, curettage, or shave removal of lesions. Sites were randomized and patients applied AHO, Neosporin (Poly/Pab/Neo), and Polysporin (Poly/Bac) to wounds, leaving one untreated as a control. Patients and providers were blinded to which topical was used on which wound. The methods section did not describe how randomization was achieved. Participants were instructed to wash the sites once per day, and treatment was applied three times daily. Patients returned to the clinic on days 1, 4, 7, 11, 14, and 18 after the initial procedure for evaluation of the wounds by investigators.\textsuperscript{11}

Grading scales of erythema, edema, epithelial confluence, crusting, and scaling
were used to compare the efficacy of AHO and the ABO. A 5-point scale was used to evaluate the sites with 0 indicating poorer outcomes, and 4 more positive outcomes. Based on these numbers, a mean clinical grading score was given, and results were provided in a graph. Actual numbers, confidence intervals, and p-values were not given in the article outside of graphs. The findings were that AHO had significant improvements in erythema (days 7-18), edema (days 4 and 7), epithelial confluence (days 7-18), and general wound appearance (days 7-18) when compared to the ABO. There were no reported differences in efficacy when the Neosporin was compared to the Polysporin. Investigators evaluated the overall appearance of the wounds and found PBO to have the most superior; the results are shown in Figure III. Photographs were taken of wounds and included in the study. Transepidermal water loss was also measured and was found to be significantly decreased for the PBO site on day 4 when compared to the other treatments and the control. Other results were not statistically significant. Patients ranked the sites daily on wound appearance, which resulted in the ranking of AHO as best followed by Polysporin, Neosporin, and untreated site (worst). There were no reports of adverse drug reactions including ACD.11

Draelos et al

Draelos et al12 was a randomized control study designed to determine if topical ABOs were necessary for healing wounds resulting from dermatological procedures. The study recognized that the use of topical antibacterial agents are known to cause allergic contact dermatitis (ACD), and may contribute to antibiotic resistance, and sought to determine if Aquaphor Healing Ointment (AHO), a petrolatum-based ointment, would be an adequate substitute. Subjects were 50 to 83 years old with Fitzpatrick skin types I, II,
or III. Individuals with known allergies to materials being used in the study, as well as those with health conditions that may have interfered with study results were excluded. Research was completed over 28 days with 30 participants. Setting was described as multicenter outpatient dermatology clinics. Each subject had two seborrheic keratoses measuring from 6 to 19mm removed from their trunk or abdomen. One wound was treated with Aquaphor and the other with Polysporin in a double-blinded fashion twice daily. The methods section did not describe how randomization was achieved. Wound healing and subjective irritation were assessed at days 7, 14, and 28.

Analysis of the information gathered indicated there was no difference in the healing of wounds treated with the ABO when compared to those treated with PBO. The results were obtained using erythema, edema, epithelial confluence, crusting, and scabbing as measures of wound healing. Investigators ranked each criterion from 0 to 4 with worse outcomes at 0, and better outcomes at 4. Based on these numbers, a mean clinical grading score was given, and results were provided in a graph. Actual numbers, confidence intervals, and p-values were not given in the article outside of graphs.

Investigators also evaluated the overall appearance of the wounds, and Figure I shows there was no significant difference. Photographs were taken of wounds and included in the study. Transepidermal water loss (TEWL) was measured, and differences in the results were not considered statistically significant. Subjects were also asked to rank their wound sites, and results were a mean ranking score of 1.62 for the PBO, and 1.38 for the ABO, which was found to not be statistically significant. One case of allergic contact dermatitis was reported in the Polysporin group. No other adverse events were reported and no patients were lost to follow up.
Taylor et al

Taylor et al\textsuperscript{13} was a double blind randomized control trial which compared the use of Polysporin ointment and Aquaphor Healing Ointment (AHO) on clean wounds to determine if topical antibiotics were necessary for effective wound healing.\textsuperscript{13}

Twenty African American participants from 18-70 years old with Fitzpatrick skin types IV, V, or VI were included in this 21-day study. The setting was described as single-center, but exact location was not disclosed. Subjects had one dermatosis papulosa nigras ranging from 3-5mm in diameter removed from each side of their face. Patients were instructed to wash site daily with a gentle cleanser and water, then according to the predetermined randomization schedule, apply AHO to one wound, and Polysporin to the other twice daily. The methods section did not describe how randomization was achieved. Patients followed up on days 1, 3, 7, 10, 14, and 21 after surgery. Investigators used erythema, edema, crusting, scabbing, epithelial confluence, melanin confluence, and general wound appearance to evaluate the extent of wound healing. They used a 5-point scale based on visual assessment, with 0 being a poorer outcome, and 4 a more positive outcome. Based on these numbers, a mean clinical grading score was given, and results were provided in a graph. Actual numbers, confidence intervals, and p-values were not given in the article outside of graphs.\textsuperscript{13}

The results of the study found that there was no significant difference in the measurements described above for wound healing when comparing the wounds treated with Polysporin and AHO. Investigators also evaluated the overall appearance of the wounds, shown in Figure II, and determined equal appearance in terms of healing. The patients from both groups reported no difference in subjective irritation, which was
measured by the sensation of burning, stinging, itching, tingling, and pain. Photographs were taken of wounds and included in the study. There were no reported adverse reactions, including allergic contact dermatitis.\textsuperscript{13}

**DISCUSSION**

Current research comparing the efficacy of antibiotic ointments to petrolatum-based ointments shows they are equally effective in healing clean wounds. The results from strong randomized control trials support this proposition and are shown in Table II. Wounds treated with either PBO or ABO have the same incidence of edema, erythema, and epithelial confluence, the indicia of healing. Wound infections were low or nonexistent for both groups, and neither was shown to be more effectual in preventing infections. Providers who formulate treatment plans depending upon current evidence-based medicine should make the switch to using PBO on clean wounds unless there is a specific need for an ABO.

Research indicates that PBO may be the better choice, as they are not shown to be associated with ACD or antibiotic resistance. As discussed earlier, cutaneous allergic reaction to ABO is a common occurrence in the United States. There were five incidences of ACD reported in the articles reviewed.\textsuperscript{10-13} If this study had been in the general population the incidence would likely have been higher. Anyone who had known allergies to the materials to be used in the study was excluded. As everyone in the studies was older than 18 years, the likelihood that they would already know about their ABO allergy would be high, thus decreasing the number of adults who would have a first time reaction to the antibacterial ointments in the studies. As most of the articles were looking at wound healing as a primary outcome it would make sense that patients with known
ACD were excluded. The cutaneous reaction of ACD would leave the wound more susceptible to inadequate healing, infection, or scaring, which would skew the results. Due to literature detailing the high rates of occurrence of ACD to ABO,\textsuperscript{6} its use is best avoided when it is not medically necessary.

Increased rates of antibiotic resistance are worrisome, and while this was not an outcome examined in the studies, it was mentioned in all the articles\textsuperscript{10-13} as a current concern. With cases of MRSA on the rise, as well as the need for multiple types and rounds of antibiotics to kill some bacteria, this is a serious issue.\textsuperscript{1} PBO are not shown to have this association, thus should be utilized when there is not a need for topical antibiotics. PBO were not shown to have any adverse effects associated with their use.

Another benefit to using PBO is the fact that they are less expensive then ABO. Smack et al\textsuperscript{10} found that in 1996 ABO were more expensive, and the same holds true today. According to Drugstore.com\textsuperscript{14,15} 1.0 oz of Aquaphor costs $2.73, while 1.0 oz of the commonly used Neosporin costs $7.99. If a patient chooses to not purchase the ABO because of high cost and the wound goes untreated, or they use less of the medication than advised in order to save money, healing could be impacted, and an infection may result. As Trookman et al\textsuperscript{11} showed, wounds treated with any ointment (ABO or PBO) resulted in better wound healing when compared to an untreated wound.

Patient compliance was difficult to measure in these studies and was not included except in Smack et al.\textsuperscript{10} In the methods section for the other three studies it was indicated that medications were dispensed, but not how much the patient had used of the medication, nor was there any way to insure the prescribed application frequency was adhered to. With Smack et al,\textsuperscript{10} patients had to return the container at the end of the study
to determine how much of the ointment was used. This helped with determining if both groups were using the same amount of ointment, increasing the likelihood that the groups were prognostically balanced at the study’s completion.

An interesting and beneficial aspect of the Trookman et al,11 Draelos et al,12 and Taylor et al,13 studies was that each patient had at least two clean wounds as a result of their procedure, and the PBO and the ABO could be compared on one individual. By comparing the wounds on one subject, the prognostic factors were assured to be close to the same, which increased the study’s validity. Trookman et al’s11 approach to using a laser to make 4 wounds took things a step further in that all of the wounds were the same size and depth, making them in effect prognostically identical at the start of the study. Using the laser and detailing the procedure should make the results completely reproducible. An important aspect of patient compliance that the studies11-13 failed to mention in their methods section was how patients were able to keep wounds and treatments separate. If the patients got confused about which ointment went on which wound, results would be skewed.

In all of the studies10-13 the majority of the measures for adequate wound healing were the investigator’s subjective opinion of the wound’s appearance. Attempting to quantify the qualitative data for analysis may or may not adequately measure wound healing. The majority of the studies11-13 failed to include actual numbers, confidence intervals, and p-values in their articles. This could impact the perception of the stated results for an individual who was critically appraising the article and wanted to see raw numbers rather than graphs.

Some quantitative data were used, as two of the studies11,12 measured
transepidermal water loss as a gauge for wound healing. TEWL is used to assess the barrier function of human skin, and is a good measure of progress in epidermal wound healing. The lower the number, the higher functioning the barrier, as less water is seeping through the epidermal layer. The opposite is true for higher numbers. This technique is beneficial as it gives a solid number by which to measure wound healing, but it is also operator dependent. The two studies that used this technique presented conflicting data; Trookman et al\textsuperscript{11} found that the water loss for PBO was significantly lower, while Draelos et al\textsuperscript{12} found the differences to not be statistically significant. The disparity of results could be attributed to operator error or study size. Both studies had fewer than 30 participants, which may account for the discrepancy in what was deemed to be statistically significant.

Sample size is an important factor when determining the validity of a study. The limitations of three of the studies include their small sample size. While quality data was collected and provided, the validity of the studies was decreased because of sample sizes of 20 participants\textsuperscript{11,13} or 30 participants.\textsuperscript{12} Smack et al\textsuperscript{10} had a sample size of 922, which increases the authenticity of its findings. As often found in studies with more participants, more patients were lost to follow up. Thirty-eight were lost to follow-up in the Smack et al study.\textsuperscript{10} The other studies had no attrition.\textsuperscript{11-13}

Each of the studies lasted for either 18 days,\textsuperscript{11} 21 days,\textsuperscript{13} or 28 days.\textsuperscript{10,12} There are pros and cons to having shorter study lengths. Having a shorter time frame will likely lead to fewer patients lost to follow up as indicated above. On the other hand, while these periods of time are long enough to determine wound healing and to look for any cutaneous reactions to the medications, it is too short a period to look at a very important
patient outcome: scarring. An essential aspect of wound healing is the final aesthetic result. Based on the length of the studies, it cannot be determined if PBO or ABO are equally strong in preventing or decreasing the appearance of scars. It was beneficial that some of the studies11-13 included photographs of the healing wounds. In the articles only one patient’s progress from each study group was shown. It can be assumed that this is a photo that best supports the researcher’s findings. A link where all of the participant’s progress is chronicled in photos would be beneficial. As “a picture is worth a thousand words,” actually seeing the final product could be more effective in convincing the patient population of PBO’s value.

A common issue with these studies11-13 that could lead to bias is that Beiersdorf Inc supported the publication of these articles. Aquaphor was used as the petrolatum-based ointment in three of the four studies, and Aquaphor is manufactured by Beiersdorf. Each of these studies also included a researcher who has worked in some capacity for Beiersdorf. As the company was funding the research it might pressure investigators to skew their findings to support the company. While randomization should help offset this bias, it still exists.

The topic of this systematic review was a therapy question, and therefore choosing a randomized control trial was the best way to answer the clinical question. Randomization is a cornerstone of a randomized control trial. It enhances a study’s validity by decreasing bias, and increases the chances that the control and intervention group both start and end with the same prognosis. All studies10-13 stated that the subjects were randomized and were double blinded. While some studies11-13 indicated that they were double blinded, and that randomization had occurred, they failed to state how this
randomization transpired or if it lasted through the entire trial. While the studies performed were, for the most part, high quality in design, they had some limitations.

All of the studies were examined using GRADE criteria to determine their quality. All of the studies were initially ranked high because of their design as randomized control trials. Smack et al had good methodology. Some of the outcomes had subjective measurements, but not enough so that the study would be lowered. There were no inconsistent results, indirectness of evidence, imprecision, or detectable bias. This study maintained a high measure of quality. Trookman et al was initially graded high, but after taking into account its small sample size, subjective measurements, and possible publication bias, it was downgraded to a low level of quality. Draelos et al was downgraded due to its small sample size, subjective measurements, and possible publication bias. Quality for this study was measured as low. Taylor et al was downgraded to a low level of quality due to its small sample size, subjective measurements, and possible publication bias. Quality assessment was summarized in Table I.

Future studies may be beneficial, but are unlikely to present findings that differ from current research. The study completed by Smack et al was extremely beneficial in determining that PBO were as effective as ABO in wound healing due to the study’s design and high quality of evidence. Any further studies should be double blind, randomized control trials with large sample sizes, and should seek to avoid sources of bias. Future researchers could expand their investigation a step further and determine which, if any, petrolatum-based ointment is the most effective in wound healing, making sure to use an untreated wound as a control. Another important outcome that
investigators could pursue is increasing the length of the studies to see if there is any difference in appearance of scars between the two groups.

CONCLUSION

Any additional research completed is unlikely to change current evidence, but will add to its strength. There is strong data supporting the use of petrolatum-based ointments rather than antibacterial ointments for use on clean wounds. Petrolatum-based ointments are equally as efficacious in wound healing, and are also not associated with the adverse reactions that antibacterial ointments are. Current concerns of antibiotic resistance and common allergic contact dermatitis to antibiotic ointments calls for cautious use of these medications.
References


Table I. Characteristics of Reviewed Studies

<table>
<thead>
<tr>
<th>Design</th>
<th>Limitations</th>
<th>Inconsistency</th>
<th>Indirectness</th>
<th>Imprecision</th>
<th>Other considerations</th>
<th>Antibacterial Ointment</th>
<th>Petrolatum Ointment</th>
<th>Quality</th>
<th>Importance</th>
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<tr>
<td>Smack et al⁹</td>
<td>Limitations</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>None</td>
<td>444/922 (48%)</td>
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<tr>
<td>Trookman et al¹⁰</td>
<td>Limitations</td>
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<td>Imprecise*</td>
<td>Possible Bias</td>
<td>20/20 (100%)</td>
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<tr>
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<td>Limitations</td>
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<td>No</td>
<td>No</td>
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<tr>
<td>Taylor et al¹³</td>
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<td>No</td>
<td>No</td>
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<td>20/20 (100%)</td>
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</tr>
</tbody>
</table>

* Small sample size
** Measurements of outcomes were subjective
θ Patient compliance was not measured
❖ Study sponsored by drug manufacturer
Table II. Summary of Findings

<table>
<thead>
<tr>
<th>Author (Year)</th>
<th>Participants/Design</th>
<th>Wound Healing Day 28</th>
<th>ACD</th>
<th>Infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smack et al (1995)&lt;sup&gt;10&lt;/sup&gt;</td>
<td>922 Randomized Control Trial</td>
<td>Equally Effective</td>
<td>ABO: 4 PBO: None</td>
<td>ABO: 4 PBO: 9</td>
</tr>
<tr>
<td>Trookman et al (2010)&lt;sup&gt;11&lt;/sup&gt;</td>
<td>20 Randomized Control Trial</td>
<td>Equally Effective</td>
<td>ABO: None PBO: None</td>
<td>ABO: None PBO: None</td>
</tr>
<tr>
<td>Draelos et al (2010)&lt;sup&gt;12&lt;/sup&gt;</td>
<td>30 Randomized Control Trial</td>
<td>Equally Effective</td>
<td>ABO: 1 PBO: None</td>
<td>ABO: None PBO: None</td>
</tr>
<tr>
<td>Taylor et al (2010)&lt;sup&gt;13&lt;/sup&gt;</td>
<td>20 Randomized Control Trial</td>
<td>Equally Effective</td>
<td>ABO: None PBO: None</td>
<td>ABO: None PBO: None</td>
</tr>
</tbody>
</table>

Patient: Patients with clean wounds
Intervention: Petrolatum based ointment
Comparison: Antibacterial ointments
Outcome: Equal effectiveness for wound healing
Figure I. Trookman et al Investigator-Graded wound Appearance

Fig 3. Investigator grading of general wound appearance (mean scores). Wound appearance grading scale: 0 = poor, 1 = fair, 2 = good, 3 = very good, 4 = excellent. P values significantly different from: all other treatments; and untreated site score.
Figure II. Draelos et al Investigator-Graded Wound Appearance

**Fig 2.** Investigator grading of general wound appearance. Scale: 0 = poor, 1 = fair, 2 = good, 3 = very good, 4 = excellent.
Figure III. Taylor et al Investigator-Graded Wound Appearance\textsuperscript{13}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{graph}
\caption{Investigator grading of general wound appearance. Scale: 0 = poor, 1 = fair, 2 = good, 3 = very good, 4 = excellent.}
\end{figure}