A Qualitative and Quantitative Assessment of the Application and Use of Topical Acne Medication by Patients

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Management of acne requires proper application of medication and compliance with its recommended use. The amount of medication actually required to completely and effectively treat facial acne has undergone limited study. The development of a structured method of medication application is likely to promote improved patient compliance, enhance effective use of medication, and limit waste of medication. This article discusses the implications of vehicle type; application methodologies and patient education regarding compliance, efficacy, and longevity of use of a fixed amount of product; and medication cost related to treatment of acne vulgaris.

What is the significance of product consumption as it relates to treatment of acne vulgaris?

One of the challenges related to the use of topical medication is knowing how much to prescribe to adequately cover a designated area of skin over a finite period. Assessment of product consumption is significant for several reasons. Practitioners may choose to limit the amount and/or duration of use depending on the type of medication prescribed. Additionally, clinicians may choose to limit the amount of prescribed medication to prevent prolonged product use that is not supervised by appropriate professional follow-up. Clinicians also may be able to assess patient compliance by evaluating how much medication could have been used by the patient based on the total quantity prescribed (initial prescription plus refills) correlated with the recommended frequency of use over a given period.

The amount of medication used by a patient correlates directly with the cost of therapy. Applying more medication than needed to cover a designated skin region leads to product waste, increased cost of therapy, and possibly an increased risk of adverse effects. Third-party payment for medication sometimes is based on what the third party determines to be an appropriate quantity for use over a designated period (eg, one month supply per prescription refill).

Does the method of product application affect the amount of medication actually used by the patient?

As discussed in more detail later, the method of product application and the physical characteristics of the vehicle may influence the quantity of product consumed per application and also may impact therapeutic outcome if the medication is not spread evenly over the region it is intended to cover.[1,2] In addition, uneven distribution of a topical antibiotic may potentially increase the emergence of antibiotic-resistant bacterial strains if adequate cutaneous and follicular concentrations are not achieved.[2] Therefore, patient education regarding the method of product application is an important component of successful treatment.

The physical characteristics of the formulation may affect the quantity of product used per application.[1] Some vehicles may be easier to manage without dripping or spillage, while others may spread

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more easily, especially over diffuse regions of application such as the chest or back.

What data are available in the literature that evaluate how much medication must be applied to provide adequate coverage of a given area of skin?

Data are limited on the methods used to evaluate how much medication must be dispensed to provide an adequate quantity for use over a given period. The objective of most studies was the enhanced awareness of patients and physicians regarding the application of too much or too little medication.[3] Shelley and Shelley[4] devised the "K" test to assist patients in determining if they have applied too much medication to their skin. After the application of a topical product, a tissue is used to blot the skin surface. If the tissue is soiled, a wasteful amount has been applied. It is important to recognize that proper use of the test assumes that medication has been physically spread evenly into the skin.

Another method that helps patients measure the application of medication is a fingertip unit (FTU), defined as the area encompassing the region of a human finger extending from the distal volar tip to the first joint crease (at the distal interphalangeal joint).[5-7] One estimate concluded that the FTU of a man contains 490 mg of ointment and covers 312 cm^2 of skin area, while the FTU of a woman contains 430 mg of ointment and covers 257 cm^2 of skin area.[6] Correlated with the quantity of ointment required to cover the flat side of a hand (approximately 150 cm^2), approximately 250 mg (0.25 g), or 0.5 FTU, is needed. In a study evaluating the application of several vehicles, such as ointments, solutions, and creams, 100 mg of topical medication was effectively spread by patients over an average area of 60.5 cm^2 of skin.[7] This adjusts to 250 mg of product covering 151 cm^2 of skin area. Another study evaluating the area of coverage with application of the contents of a single sachet (250 mg) of imiquimod 5% cream showed that the average area covered was 196 cm^2 on pigskin and 386 cm^2 on human skin (arm).[3]

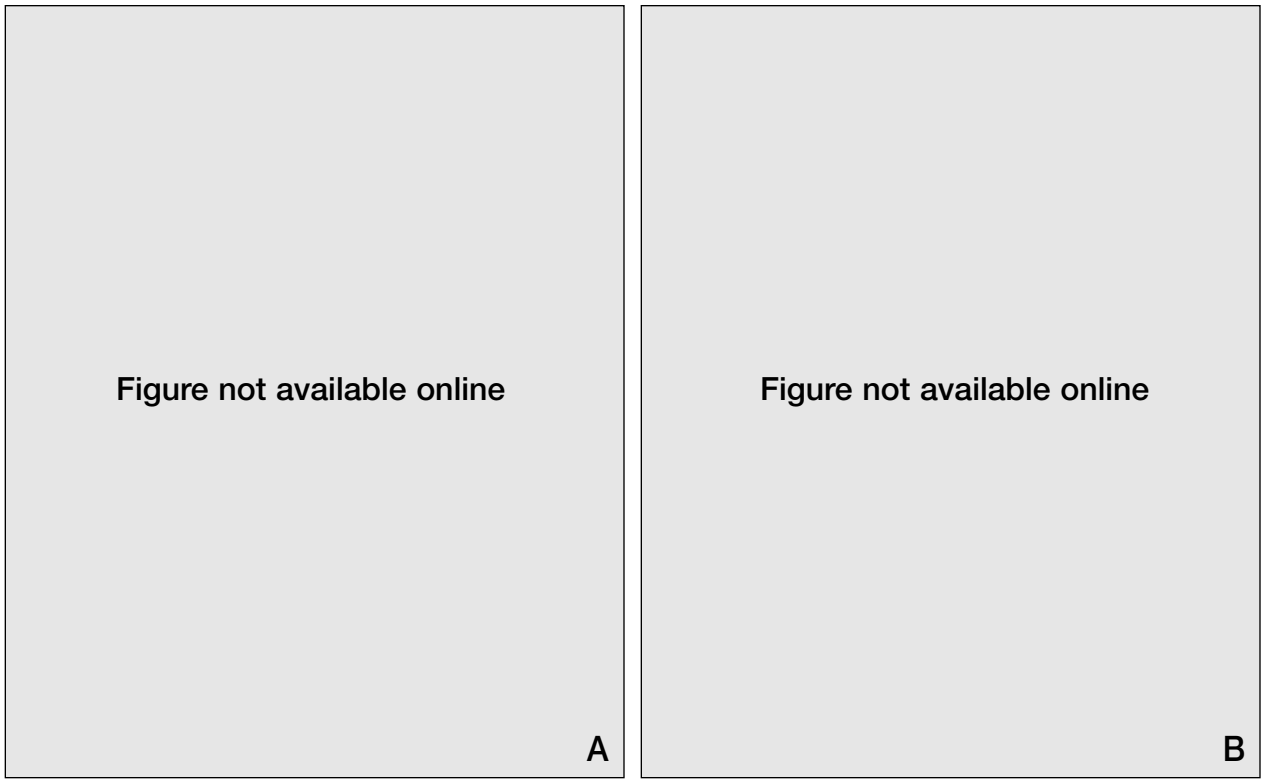
Is there additional information that correlates methods of product application and vehicle characteristics with product consumption?

A recent evaluation completed by the author was designed to evaluate quantity of product consumed and method of application of topical medication to the face.[1] The objectives of the project were to: (1) evaluate the quantity of product used to adequately and evenly cover application to the face inclusive of the forehead, temples, cheeks, nose, and chin; (2) determine methods of application and quantity of product used by patients who were not educated on proper use; (3) develop a practical method of application that can be taught to patients by clinicians or professional office staff to optimize confluent product application over the facial region; and (4) assess the impact of vehicle characteristics on quantity of product utilized.[1]

The evaluation included 3 components—phases 1, 2, and 3.[1] The investigator had previously determined that a specific application method achieved even distribution of both water-based gel and cream vehicles on the face using formulations containing visible green tint. However, the quantity (weight) of product used with each application was not assessed; this was because the only objective at that time was to determine if the application method could provide even product distribution to the face (forehead, temples, cheeks, nose, and chin).[1]

In all 3 phases of the evaluation, an FTU was defined as only the pulp region of the finger, which represents approximately one third to one half of the FTU described above from previous literature. Initially, patients were instructed to apply the product by dot application of an FTU to each of 10 designated points (Figure), followed by spreading the product onto the skin to create confluent application over the entire face. The study used 4 vehicles: water-based gel in a tube, thick-viscosity cream in a jar, cream contained in a tube, and lotion contained in a bottle.[1]

Phase 1 of the evaluation included 2 men who were educated on the method of application.[1] To evaluate uniformity of spread on the skin, each vehicle was previously mixed with less than 1 mg of fluorescein as described in the literature to allow for UV light (Wood light) exposure to illuminate the skin areas where fluorescein-containing vehicle was deposited.[3] After completion, UV light exposure was used to evaluate whether the product was spread evenly over the face. Each patient applied 2 of the 4 possible assessed vehicles. The application of each vehicle was separated by 4 weeks to allow for no interference from fluorescein contained in the previously applied vehicle; this was confirmed by facial exposure to UV light to ensure that no areas of facial skin fluoresced prior to application of the second vehicle. Both patients underwent open use testing on the upper anterior forearm and standard patch testing over 96 hours on the back using a fluorescein-containing product prior to initiation of the trial. No evidence of skin irritation or allergic contact dermatitis was observed.[1]



Individual medication application points.

Phase 2 of the evaluation included 10 patients (5 women and 5 men) aged 19 to 26 years.[1] The objective of this phase was to evaluate the quantity of medication used after product application to the skin with the 4 vehicles used in phase 1 (without the addition of fluorescein). The water-based gel was applied from a tube once daily for 7 days; additionally, it was applied from a wide-mouth jar over a separate 7-day period. The thick-viscosity cream, tube cream, and lotion were applied once daily for 7 days. Each patient used all 4 vehicles consecutively in a randomized order. The pretreatment weight of each container was recorded at baseline, after the first application of product to the entire facial region (defined as application of an FTU to each of the 10 designated application points depicted in the Figure), and at the end of the 7-day period using a precision balance.[1]

Phase 3 of the evaluation was designed to determine if the suggested method of application provided adequate coverage, which correlated with therapeutic benefit.[1] Twenty patients (10 women and 10 men) aged 18 to 22 years, with untreated acne vulgaris and presenting with a minimum of 12 inflammatory lesions involving the face (forehead, cheeks, nose, and chin), were included; baseline inflammatory lesion counts were recorded. Patients were prescribed a 2-g sample tube and a 45-g tube of benzoyl peroxide 5%-clindamycin 1% water-based gel to be applied once daily. No other topical therapies were prescribed during the 30-day evaluation period. All tubes were weighed prior to use. At the initial visit, the patients were not given application instructions; they were simply directed to apply the product for facial acne using the sample tube while the investigator observed. The sample tubes were weighed after the initial application. The patients were then instructed to follow the recommended application method described in phase 2. Subsequent product application was once daily for 30 days using the 45-g tube; the weight of each tube was recorded at the end of the 30-day usage period using a precision balance. Inflammatory lesion counts were recorded at the final visit (day 30).[1]

The results of phase 1 of the evaluation indicated that the recommended method of application allowed for even distribution of all 4 vehicles.[1] The results of phase 2 of the evaluation are reported in the Table, which includes the quantity (weight) of each vehicle used by all 10 participants after a single application and after 7 days of once-daily application.[1]

During phase 3 of the evaluation, at the first application prior to instructions being given

Quantities of Vehicles Applied Using Recommended Application Method Based on Once-Daily Use*

Patient No.	Application	Gel (Tube), g	Gel (Jar), g	Thick-Viscosity Cream (Jar), g	Cream (Tube), g	Lotion (Bottle), g
1	SA	0.7	0.8	0.8	0.7	0.9
	7 d	5.0	5.8	5.7	5.1	5.8
2	SA	0.6	0.8	0.7	0.8	0.9
	7 d	4.5	5.9	5.1	5.7	6.5
3	SA	0.6	0.8	0.7	0.7	0.8
	7 d	4.3	5.9	5.2	5.1	5.9
4	SA	0.7	0.7	0.8	0.7	0.7
	7 d	5.0	5.0	5.7	5.0	5.0
5	SA	0.7	0.8	0.8	0.7	0.9
	7 d	4.3	5.8	6.2	4.3	6.6
6	SA	0.7	0.8	0.9	0.8	0.9
	7 d	5.3	5.6	6.6	5.9	6.8
7	SA	0.8	0.9	0.8	0.8	0.9
	7 d	6.0	6.5	6.0	5.9	7.0
8	SA	0.7	0.7	0.8	0.6	0.8
	7 d	4.6	5.3	6.0	4.4	6.9
9	SA	0.7	0.8	0.7	0.6	0.8
	7 d	5.2	5.9	5.1	4.5	6.0
10	SA	0.7	0.9	0.8	0.5	1.0
	7 d	5.5	6.4	6.1	4.0	7.4
Single use, mean		0.69	0.80	0.78	0.69	0.86
28 d,† mean		19.88	23.24	23.08	19.96	25.56

*SA indicates after a single application; 7 d, after 7 days of once-daily application.
†Extrapolated from 7-day data (mean from 10 participants ×4). Extrapolation does not correct for potential increment in product waste with repeated use, which may increase total amount applied over time.

regarding application method, 7 patients "spot" applied the product to lesions only.[1] The amount of product applied by these 7 patients in the single application averaged 0.34 g (range, 0.2–0.4 g). The remaining 13 patients used a mean of 0.9 g in a single application (range, 0.6–1.2 g), with 3 patients applying essentially 2 "full coats" of product to the face. At the initial visit, after instructions were given on the recommended method of application, a mean of 0.71 g (range, 0.5–0.8 g) was used after the first (single) application. After 30 days, the mean quantity of product used based on tube weight at study endpoint compared with baseline was 21.6 g. The mean number of inflammatory lesions was 13.5 at baseline and 5.1 after 30 days (62.2% mean inflammatory lesion count

reduction), suggesting that the recommended method of product application correlated with clinical improvement.[1]

Conclusion

Data are limited on the determination of the quantity of medication required over a period for treatment of facial acne vulgaris. Standardized methods of topical application designed to assure coverage of the skin area requiring treatment and to optimize use of the product without wastage also have undergone limited evaluation, with minimal published data available to guide clinicians. As a result, many practitioners use their own methods based on individual perception, clinical experience, and/or recommendations given by manufacturers of specific products.

The methods of topical drug application for facial acne vulgaris described herein have been found to be useful in clinical practice and have been correlated both with product consumption over time using different vehicles and with a positive therapeutic outcome. Use of a topical application method that enables even spread and distribution of a product is significant, allowing for consistency of topical medication use and reduced product waste. Education of patients regarding the recommended method of topical application is a vital component of optimal management. Lack of patient education may lead to either underutilization or overutilization of a product. In addition, the quantity of drug used with topical application may be affected by the type of vehicle used, product characteristics (eg, viscosity), and packaging (eg, tube, jar). Understanding of quantity of product used per application allows for prediction of how long a given quantity of prescribed medication should last if applied appropriately and used as directed.

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