Why Do Antiperspirants Fail?

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Unwanted axillary perspiration remains a common dermatologic problem. Clearly, the biggest advance in the treatment of this condition is the injection of botulinum toxin, which produces dramatic long-term sweat reduction. Yet, antiperspirants remain a viable effective alternative in some patients. Antiperspirants can even be combined with botulinum toxin to prolong or increase the effect of long-term sweat reduction. Optimizing the effect of traditional antiperspirants involves understanding how they function and then identifying why they fail. This article examines the realm of the antiperspirant from the practical aspect of optimal hyperhidrosis treatment.

What Is an Antiperspirant?

Antiperspirants are classified by the US Food and Drug Administration (FDA) as over-the-counter (OTC) drugs and must follow certain safety guidelines. The most important guideline is that the active ingredient must be selected from an approved list and used in concentrations no greater than specified. The guidelines for antiperspirant formulation are listed in a monograph published by the FDA. The first antiperspirant appeared on the market in the United States in 1919.

Antiperspirants are intended to reduce the amount of sweat that is released by the eccrine sweat glands and ducts onto the skin's surface. They are distinct from deodorants, which are intended simply to make the skin smell better. Most antiperspirants function as deodorants by decreasing the substrate available for bacterial growth; however, deodorants do not function as antiperspirants.

What Is Sweat?

Sweat can be divided into apocrine and eccrine perspiration. Eccrine sweat is a clear, odorless fluid of pH 4 to 6.8, composed of 98% to 99% water, sodium chloride, lower fatty acids, lactic acid, citric acid, ascorbic acid, urea, and uric acid. Apocrine sweat is a turbid, viscous, odorless fluid of pH 6 to 7.5 that has a high content of water in addition to protein, carbohydrate waste materials, and sodium chloride. The amount of eccrine perspiration is much greater than the amount of apocrine perspiration. An effective antiperspirant must reduce both types of perspiration.

How Does an Antiperspirant Reduce Sweat?

The reduction of apocrine and eccrine perspiration on the body is a daunting task. In the axilla, there are some 25,000 eccrine glands capable of producing large quantities of perspiration in response to heat and emotional stimuli. Antiperspirants work by coagulating the protein in the sweat duct. Antiperspirants contain metal salts that combine with intraductal keratin fibrils to cause eccrine duct closure and formation of a horny plug to obstruct sweat flow to the skin surface.[1]

The only 2 metal salts that are presently used in antiperspirants are aluminum and zirconium.[2] The original antiperspirant formulation was a 25% solution of aluminum chloride hexahydrate in distilled water, but it was extremely irritating.[3] More modern antiperspirant formulations contain aluminum chloride, aluminum chlorohydrate, aluminum-zirconium chlorohydrate, and buffered aluminum sulfate.[4] These metals provide a better balance between efficacy and skin irritation.

How Are Antiperspirants Evaluated?

The FDA has established that an antiperspirant must reduce sweat by at least 20% to be marketed in the United States as an effective product. Antiperspirants that are labeled as highly effective must reduce sweat by at least 30%. For most dermatologic patients, this amount of sweat reduction would be considered woefully inadequate. This is the main reason that not all antiperspirants provide sweat reduction in individuals with abundant perspiration. The ingredients in antiperspirants were designed to perform at a reduction level of 20% to 30%.

Efficacy is defined as the percentage of reduction in the rate of sweating achieved after application of the antiperspirant product. The percentage of sweat reduction can

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The author reports no conflict of interest in relation to this article.

be determined gravimetrically.[5] This involves weighing an absorbent pad and then placing the pad in the armpit while the subject is induced to sweat in a hot room. The pad is then reweighed after a specified time in the hot room, and the increase in weight per time is converted into a sweating rate. The rate can be compared before and after the application of an antiperspirant.

How Can Antiperspirants Work Better?

An effective antiperspirant must quickly create a long-lasting plug in the sweat duct ostia. This is best accomplished by evenly spreading the antiperspirant in the axillary vault. If the antiperspirant does not touch the sweat duct, it will not work. This is similar to the way that botulinum toxin will only work for sweat reduction if it is injected over the entire area of moisture production. The ability to evenly distribute the antiperspirant accounts for the decreased efficacy of aerosol spray formulations, which may easily miss areas containing sweat glands.

The most effective antiperspirants are the sticks and lotions. These are vigorously rubbed into the axilla to remove the product from the specially designed applicator and distribute the chemical throughout the armpit. The active agent in the newer antiperspirants is aluminum-zirconium tetrachlorohydrex-gly complex. This complex can reduce axillary perspiration by 40% to 60%. These aluminum salts have an acidic pH of 3 to 4.2.[6] Irritation is reduced by incorporating skin-conditioning agents, such as dimethicone or cyclomethicone, into the formulation. The silicone imparts soothing properties to the skin irritated by the antiperspirant ingredients.

Why Do Antiperspirants Fail?

Understanding why antiperspirants fail is indeed complex. Some of the reasons have been previously discussed. The most likely reason for antiperspirant failure is that the formulation does not contain an optimal active ingredient mix and appropriate vehicle construction to deliver the best results. For this reason, patients with sweating problems should not select unbranded antiperspirants sold at a lower price point. Better antiperspirant formulations contain costlier ingredients and will not be the cheapest on the shelf.

Another common reason for antiperspirant failure is the lack of an even film that covers the entire armpit. The antiperspirant must be in contact with each and every eccrine and apocrine duct in the armpit to work. Thus, the applicator should be domed to fit into the axilla and dispense a thick, even film of the product. The film must be somewhat water resistant or it will be rinsed away by perspiration before the plug can be formed in the ducts. For this reason, the armpit should be dry when the product is applied. Many dermatologists recommend that patients apply an OTC or prescription antiperspirant and then occlude the armpit with plastic wrap. If the patient sweats profusely under the occlusion, the perspiration may wash away the active ingredients before a plug can be formed. Thus, the occlusion may decrease the efficacy of the antiperspirant rather than increase efficacy due to enhanced penetration.

Antiperspirant failure may also be caused by inconsistent application. Compliance is important to achieve optimal results. It takes approximately 10 days of antiperspirant application for the complete plug to be formed in the sweat duct. If the patient decides after 3 days of application that the antiperspirant has not worked sufficiently, the product has not been given an adequate trial. Furthermore, the plug is completely gone 14 days after the last application. Continuous daily application is necessary to achieve and maintain the sweat-reduction effect.

Also to be considered is the depth of the plug within the sweat duct. Plugs that are more deeply placed in the sweat gland will provide better sweat reduction than those that are superficially situated. If the plug is very close to the surface, it is possible that it can be removed by the rubbing of clothing or shaving. Patients who complain that antiperspirants do not work may wish to wear loose-fitting clothing around the armpits and use only light razor pressure when shaving the armpits. The deepest plugs are created by prescription aluminum chloride solutions, but these formulations must be used carefully, as they can irritate skin and ruin natural fabrics, such as rayon, cotton, and silk. More superficial plugs are created by OTC antiperspirants containing aluminum chlorohydrate. Intermediate-depth plugs are created by OTC antiperspirants containing aluminum-zirconium chlorohydrate.

What Can Be Done to Optimize Topical Antiperspirant Efficacy?

Optimizing antiperspirant efficacy requires the use of a well-formulated product that is consistently applied to the entire armpit as a thin film. Efficacy can be further enhanced by applying the antiperspirant twice daily, in the morning and at bedtime. The bedtime application is actually more important than the morning application because the body is at rest and sweating reduced. The reduced sweating decreases the removal of the antiperspirant from the armpit and allows the active ingredient to remain in contact with the skin longer, creating a stronger plug. Antiperspirants specifically designed for

bedtime use will be entering the marketplace shortly. These products may also be useful for patients with mild daytime hyperhidrosis.

Summary

Antiperspirants are a commonly used OTC drug. The creation of a deep plug within the sweat duct ostia is the key to excellent efficacy. This plug is best created by morning and nightly application of an even, thin film of antiperspirant to the entire dry armpit. These simple tips may be helpful to the patient who is requiring treatment for hyperhidrosis.

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