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Colloidal Oatmeal: A Natural Solution for a Dysfunctional Skin Barrier

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INTRODUCTION

Atopic dermatitis (AD) is a chronic, pruritic inflammatory skin disease characterized by periods of flare and remission, and is associated with substantial morbidity and costs to the patient and health care overall. Topical prescription treatments and over-the-counter products, especially moisturizers, along with lifestyle modifications and avoidance of known AD-flare triggers, form the backbone of long-term AD management. More recently, increasing attention is being paid to preventive strategies, often founded on the clinical translation of inherent AD genetic factors, to prevent or delay disease onset. Importantly, products that compensate for the inherent barrier defects found in AD may be central to this approach. This article reviews the role of "moisturizers" in the prevention and management of AD, with emphasis paid to the incorporation of colloidal oatmeal into this strategy.

PREVALENCE AND BURDEN OF ATOPIC DERMATITIS

Atopic dermatitis affects an estimated 9% to 30% of people in the United States.[1] It occurs most frequently in children, with upwards of 60% of patients experiencing symptoms within the first year of life; 90% experience symptoms by age 5.[2] Symptoms vary depending on patient age and disease severity, but the hallmark symptom of AD is intense itching, an essential diagnostic feature. Atopic dermatitis is often referred to as the "itch that rashes" as a plethora of clinical findings generally follow suit, including erythema, edema, xerosis, erosions/excoriations, oozing, crusting, and lichenification.[2] The itch of AD has a significant impact on quality of life for these patients, and the difficulty dermatologists face in controlling this itch stems from the multitude of peripheral and central mechanisms and mediators involved in its pathogenesis.[3,4]

Childhood onset is often associated with the subsequent development of food allergies, asthma, and allergic rhinitis, an association known as the "atopic march" especially when patients go un- or undertreated.[5] When considering children specifically, AD has a significant adverse impact on development, and is associated with poor sleep patterns and psychosocial functioning. Even more concerning, this suffering is not limited to the pa-

DISCLOSURES

Dr. Friedman discloses he is a consultant and serves on the advisory board for Aveeno®, a Johnson & Johnson Consumer Companies, Inc. product line.

tient, as many patients with AD are young children, and therefore parents and siblings are often adversely affected by AD as well.[2]

The main risk factors for AD are a family history, present in approximately 70% of patients, and loss-of-function mutations in the *FLG* gene, which encodes profilaggrin.[2] These loss-of-function mutations result in disruptions to skin barrier function, including abnormal corneocyte adhesion, enhanced transepidermal water loss (TEWL), and dysregulated skin pH. Although the pathophysiology of AD is not yet fully understood, such disruptions to the skin barrier (because of *FLG* mutations, environmental- or cleanser-induced dryness, or even skin aging) are central factors in the onset and persistence of AD.[6] Disrupted skin barrier function allows for the introduction of allergens or irritants that induce inflammatory immune responses initiated by keratinocytes and dendritic cells.[2,6] Patients with AD and filaggrin mutations, as compared to those without mutations, suffer from more severe and persistent AD, as well as a higher incidence of atopic comorbidities, including asthma and allergic rhinitis.[2]

PREVENTING AND MANAGING ATOPIC DERMATITIS WITH EMOLLIENTS

The fundamental goal of AD management is to improve the skin's health by restoring skin barrier function. This is achievable with a combination of bathing and moisturizing regimens, prescription anti-inflammatory medications such as topical corticosteroids and calcineurin inhibitors, and, in severe cases, systemic therapy and/or phototherapy. In all patients, topical treatments, and especially moisturizers, are central. When used correctly, moisturizers reduce TEWL, increase skin hydration, lessen signs and symptoms of AD, and, as shown in a recent study, potentially prevent AD in high risk infants.[7] Therefore, it comes as no surprise that the 2014 American Academy of Dermatology (AAD) guidelines for the management and treatment of AD identify moisturizers as "an integral part of the treatment of patients with AD as there is strong evidence that their use can reduce disease severity and the need for pharmacologic treatment."[8] That is, moisturizers may lessen patient dependency on long-term topical anti-inflammatory agents, especially topical corticosteroids, which can be associated with a variety of adverse effects if used too frequently or inappropriately, such as cutaneous atrophy, skin lightening, telangiectasias, and in some cases systemic absorption resulting in hypothalamic-pituitary-adrenal axis suppression.[8,9]

Avenanthramides are the primary source of colloidal oatmeal's antioxidant and anti-irritant properties.

As mentioned, several recent studies suggest that moisturizing agents and emollients, applied early in life to enhance skin barrier function in at-risk children, may prevent or delay the onset of AD.[6,10] These studies emphasize that early intervention could potentially limit disease presentation or progression, highlighting the importance of proper moisturization early on.

COLLOIDAL OATMEAL IN SKIN BARRIER PROTECTION

Oats (*Avena sativa*) have been used to treat various topical skin conditions for centuries. The chemical composition of oatmeal contains several properties beneficial for soothing skin irritation and itch, maintaining skin moisture, and thereby helping to maintain healthy skin barrier function.[11] Colloidal oatmeal is derived from grinding the whole oat seed without chemical solvents, a process that preserves oatmeal's natural components.

The high concentration of polysaccharides gives colloidal oatmeal its viscosity and ability to coat and cling to the skin.[11] When applied, colloidal oatmeal forms a hydrophilic film that retains and replenishes moisture in the stratum corneum. Colloidal oatmeal helps to normalize the skin's pH.[11] Skin is a slightly acidic microenvironment with a pH of approximately 5.5. Acidity enhances the skin's barrier function, protecting against pathogen entry and maintaining the integrity of the superficial keratin layer. Patients with AD will generally show elevated levels of skin pH, and a key element in managing the condition is normalizing pH. Furthermore, soap increases the alkalinity of the skin, which makes soap selection an integral component of AD management. Topical application of oat extract can decrease skin pH to "normal," indicating that colloidal oatmeal applied to inflamed skin may act as a buffer to restore the physiologic pH.[11]

Collectively, these qualities contribute to colloidal oatmeal's ability to prevent TEWL and comorbid conditions (eg, xerosis, pruritus) that undermine the structural integrity of the skin barrier and further propagate disease. Of the long list of biologically relevant components, there are 2 key active compounds that contribute to colloidal oatmeal's beneficial effects: avenanthramides and oat oil.

AVENANTHRAMIDES

Avenanthramides are a class of phenolic antioxidant compounds unique to oats.[12] This bioactive element is the primary source of the grain's antioxidant and anti-inflammatory properties.[13] These compounds have 10 to 30 times more antioxidant activity than other oat phenolic compounds, such as caffe-

ic acid or vanillin, and 5 times the antioxidant activity of oat flavonoids.[12,14] As anti-inflammatory agents, they exert their effects by inactivating nuclear factor kappa B (NF-κB) and inhibiting inflammatory cytokines (eg, tumor necrosis factor α) in keratinocytes.[15] They also inhibit histamine release, prostaglandin biosynthesis, and cleavage of arachidonic acid from phospholipids in keratinocytes.[16,17] Specifically considering pruritus, avenathramides have shown promise in animal models, reducing animal scratching as well as inflammatory cytokines such as IL-8, implicated in itch.[16,18]

Taken together, the anti-itch and anti-irritant effects of colloidal oatmeal appear to be mediated through the avenanthramides. Recently published research suggests that colloidal oatmeal as a whole also exhibits antioxidant and anti-irritant activities, further demonstrating its effectiveness in the treatment of scaling, dryness, and itch.[19]

OAT OIL

Oat oil is composed of a mixture of several lipids, including triglycerides (83.4%), diacylglycerol (8.9%), free fatty acids (6.8%), and phospholipids (0.9%), with smaller amounts of sterols, phosphatidylethanolamine, and other compounds.[20] Oat oil treatment has also been associated with a 3-fold increase in ceramide levels in primary human keratinocytes.[21] Ceramides comprise a family of waxy lipids composed of sphingosine and a fatty acid that fill in the intercellular spaces of the stratum corneum to serve as the mortar component of the "brick and mortar" barrier.

When oat oil is fractionated, it is approximately 80% unsaturated fatty acids, which are composed of 42% to 52% linoleic acid, 27% to 32% oleic acid, and 17% to 21% palmitic acid, with smaller amounts of stearic and linolenic acids.[22] Linoleic acid is an important factor in preventing TEWL and maintaining skin barrier function by helping to maintain the "acid mantle."[20] Through these components, colloidal oatmeal appears to prevent TEWL and retain moisture in the skin barrier, which contribute to maintaining barrier function.

Colloidal oatmeal-based moisturizers have been shown to safely reduce the itching and irritation associated with AD, reduce the severity of dry skin, and reduce TEWL.

CLINICAL EFFICACY IN ATOPIC DERMATITIS

Colloidal oatmeal is approved by the US Food and Drug Administration (FDA) as an over-the-counter skin protectant. One of its approved uses is to "protect and relieve minor skin irritation and itching due to eczema."[23] In addition to the antioxidant and anti-irritant properties of colloidal oatmeal, high levels of β-glucan and starches provided by oats also contribute to the protective seal, which helps the stratum corneum retain water.

Oat-containing emollients and moisturizers are commonly used as adjuvant therapy to topical corticosteroids. Several recent studies demonstrated the efficacy of colloidal oatmeal for this use. One study enrolled 25 patients with mild-to-moderate AD (at least 5% body surface area involvement) for a 2-week period.[24] The treatment included twice-daily application of colloidal oatmeal-based cream and once-daily use of oat-based body wash in conjunction with already established topical prescriptions. Results demonstrated that daily use of oatmeal-based adjunct therapies in patients with AD improved measured outcomes at all time points and was well tolerated. Another study evaluated adjuvant treatment of mild-to-moderate AD in a pediatric population (mean age 2.4 years).[25] The adjunct therapy was a combination of colloidal oatmeal cream and a colloidal oatmeal cleanser. Patients continued their topical prescription medications but discontinued use of any other cleansers or moisturizing creams. The oatmeal-based treatment was well tolerated, reduced itching, and progressively improved the skin condition.

SAFETY OF COLLOIDAL OATMEAL

Colloidal oatmeal has a long history of safe use, and the FDA has recognized colloidal oatmeal as a safe and effective over-the-counter skin protectant. Although a large body of evidence supports the safety of oat-containing topical treatments in patients with AD, some argue that infants with AD should not be treated with these products due to potential sensitization. Most believe that the evidence of sensitization to oats after such use is insufficient. For example, a 2009 study reported that daily use of an oat-based cleansing bar and moisturizing cream did not induce cutaneous hypersensitivity reactions in cereal-sensitized adults with AD.[26] This study concluded that although these oat-containing cosmetics are not allergenic to oat-sensitized patients, it is still possible that other oat-containing skin products can trigger an allergic response in atopic individuals.

Even more recently, a long-term safety analysis assessed irritation and allergic reactions to 12 personal care products containing oatmeal (creams, cleansers, and lotions).[27] Irritation and allogenic potential were assessed by repeat insult patch testing, safety-in-use tests, and ocular studies in patients with sensitive and nonsensitive skin. The data indicated a very low potential for oatmeal-containing products to cause irritation

or allergic sensitization. No allergic reactions were reported by consumers of 445,820 oatmeal-containing products during a 3-year period.[27]

CONCLUSION

Atopic dermatitis is a serious skin disease associated with significant morbidity and costs. The primary underlying cause of AD is a dysfunctional skin barrier. In preclinical and clinical studies, colloidal oatmeal-based moisturizers have been shown to safely reduce the itching and irritation associated with AD, reduce the severity of dry skin, and reduce TEWL. Collectively, these benefits, which are mediated by colloidal oatmeal's natural components, help restore and maintain skin barrier function, thereby reducing the severity of AD and AD's sequelae. Moisturizers can reduce the dependency on topical corticosteroids and their potential adverse effects. Considered by contemporary guidelines to be a cornerstone of AD management, moisturizers may also have a future role in preventing or delaying the onset of AD. ■

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