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Review Paper

Evaluation Of 1% And 2% Ketoconazole Shampoo

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ABSTRACT

Ketoconazole shampoo, an effective antifungal treatment, is widely used to combat dandruff, seborrheic dermatitis, and various other fungal infections. The active ingredient, ketoconazole, halts the growth of *Malassezia*, a common fungus associated with these scalp issues. Available in two strengths, 1% and 2%, the shampoo can be purchased over-the-counter in its 1% form, while the 2% formulation usually requires a prescription. These varying strengths cater to different levels of severity, with the 1% option being particularly popular for mild to moderate cases due to its accessibility and minimal side effects. Originally developed by Janssen Pharmaceutica in the 1970s, ketoconazole began as an oral antifungal medication targeting systemic infections. Recognizing its efficacy in treating fungal scalp conditions, researchers explored its potential in topical applications, leading to the creation of the shampoo in the early 1980s. The patent for ketoconazole was filed in 1977, and it soon became a staple in dermatological treatment, especially for conditions like seborrheic dermatitis and dandruff. This abstract outlines the development, historical background, and therapeutic uses of ketoconazole shampoo, highlighting its significance in treating fungal infections and scalp conditions. Its antifungal properties, along with the availability of both OTC and prescription versions, make ketoconazole shampoo a vital tool in managing dermatological health.

INTRODUCTION

Ketoconazole shampoo is a well-known antifungal solution primarily used to treat dandruff, seborrheic dermatitis, and various other fungal infections of the scalp. Its active ingredient,

ketoconazole, effectively hinders the growth of *Malassezia*, a fungus commonly associated with these scalp issues. Available in two strengths—1% and 2%—ketoconazole shampoo caters to different levels of severity, with the 1% formulation available over-the-counter (OTC) and the 2% typically requiring a prescription.

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In many parts of the world, the 1% ketoconazole shampoo is readily accessible without a prescription, making it an attractive option for individuals with mild to moderate dandruff or seborrheic dermatitis. Its ease of access and minimal side effects contribute to its popularity. Studies have shown that the 2% ketoconazole shampoo can effectively eliminate fungal infections and significantly alleviate symptoms within just two weeks. Its higher potency makes it particularly useful in cases where OTC treatments have failed, though it may come with an increased risk of side effects such as hair loss, dryness, or irritation. Comparative studies have demonstrated the efficacy of both the 1% and 2% formulations depending on the severity of the condition. For instance, clinical research published in **Dermatology** found that patients using 2% ketoconazole experienced quicker symptom relief and longer remission periods compared to those using 1% ketoconazole. However, for long-term maintenance, the 1% ketoconazole shampoo is often sufficient and recommended to minimize the risk of adverse effects from prolonged use of the stronger dosage. Ultimately, whether in a 1% or 2% formulation, ketoconazole shampoo remains an essential treatment for a variety of scalp conditions caused by fungal overgrowth. The choice between the two strengths typically depends on the severity of the condition, with the 1% version suited for mild cases and regular maintenance, and the 2% formulation reserved for more severe or persistent issues. Regardless of the concentration, ketoconazole shampoo is a staple in dermatological care, known for its proven effectiveness and low risk of side effects.

The History of Ketoconazole Shampoo:

1. **Patent and Development (1970s):** Ketoconazole, a synthetic imidazole antifungal drug, was developed by the Belgian pharmaceutical company Janssen Pharmaceutica in the mid-1970s. Initially intended as an oral treatment for systemic fungal infections, ketoconazole's patent was filed in 1977, and it became commercially available in the early 1980s. As understanding of fungal scalp infections grew, researchers began exploring the potential of ketoconazole in a topical formulation, particularly as a shampoo.
2. **FDA Approval and Launch (1980s):** In 1981, the U.S. Food and Drug Administration (FDA) approved ketoconazole for oral use to treat systemic fungal infections. Shortly thereafter, ketoconazole 2% shampoo was introduced to treat tinea versicolor, seborrheic dermatitis, and dandruff. Initially, the shampoo was available by prescription only and marketed under various names, including Nizoral.
3. **Research and Widespread Use (1980s–1990s):** By the late 1980s, ketoconazole shampoo gained popularity for its effectiveness in treating severe scalp conditions like seborrheic dermatitis and dandruff. Research during this period, including a notable 1985 study by Shuster, demonstrated that regular use of ketoconazole shampoo reduced the amount of *Malassezia* yeast on the scalp, thereby alleviating dandruff symptoms. Its use continued to grow throughout the 1990s as *Malassezia* yeast was identified as a primary cause of dandruff, solidifying ketoconazole's role as a key treatment.
4. **Over-the-Counter Availability (1990s):** In the late 1990s, several countries, including the United States, made 1% ketoconazole shampoo available over-the-counter (OTC). This allowed consumers to treat mild to



moderate dandruff without needing a prescription. Meanwhile, the 2% prescription-only shampoo remained available for more severe scalp conditions.

5. **Safety Concerns and FDA Re-Evaluation (2013):** In 2013, the FDA issued warnings regarding the oral use of ketoconazole due to potential drug interactions, liver damage, and adrenal problems. Consequently, the oral form of ketoconazole was largely discontinued for treating fungal infections in the United States. However, topical ketoconazole, including the shampoo, was found to pose no similar risks and remained commercially available.
6. **Current Use and Developments:** Today, ketoconazole shampoo continues to be a widely used treatment for seborrheic dermatitis and dandruff. The 2% formulation is still available by prescription in most places, while the 1% version is sold over-the-counter in many countries under brands like Nizoral A-D. Ongoing research is exploring broader applications of ketoconazole, including potential benefits for hair loss due to its anti-inflammatory properties and ability to inhibit scalp fungal activity.

Etiology of Dandruff

Dandruff is a complex condition with multiple etiopathological pathways. Among the various factors, the role of the lipophilic yeast *Malassezia* has been widely acknowledged since 1846. Eichstedt first identified this fungus in the condition known as pityriasis versicolor. The scalp hosts a variety of microorganisms, including species from the genera *Staphylococcus*, *Propionibacterium*, and *Malassezia*. The density of these organisms can range from 10^3 to 10^5 organisms per square millimeter. During dandruff,

the levels of *Malassezia* increase by 1.5 to 2 times their normal level. The specific role of *Malassezia* in dandruff has been a topic of debate. While some argue that the quantitative microbial assessment does not solely indicate its role, others suggest that its abundance is proportional to the volume of scales it colonizes or is responsible for altered desquamation. This relationship between *Malassezia* species and dandruff has shaped treatment strategies. Antifungal preparations reduce the population of *Malassezia*, but the bacterial population remains largely unaffected. Post-treatment withdrawal often sees a recurrence of dandruff, with *Malassezia* levels returning to their initial state. Interestingly, steroids, known to suppress immune responses, also show positive treatment responses for dandruff. This raises questions about the microbial cause of dandruff, suggesting an interplay between immune suppression and microbial activity. There are seven identified species of *Malassezia* involved in dandruff formation: *M. globosa*, *M. restricta*, *M. obtusa*, *M. slooffiae*, *M. sympodialis*, *M. furfur*, and *M. pachydermatis*. However, none have fulfilled Koch's postulates as definitive pathogens of dandruff. Non-microbial factors contributing to dandruff are also well-documented. Excessive sunlight exposure, minimal scalp irritation from over-shampooing, frequent combing, certain cosmetic products, dust, and dirt can all contribute to dandruff. Despite these observations, experimental evidence supporting these assumptions remains insufficient. [1]

Factors Contributing to Dandruff

1. **Malassezia Overgrowth:** This yeast-like fungus naturally resides on the scalp. However, when it overgrows, it can feed on the oils produced by hair follicles, leading to irritation and dandruff.
2. **Dry Skin:** A dry scalp is more susceptible to flaking, resulting in dandruff. Factors like



cold weather and hot showers can further dry out the scalp, exacerbating the condition.

3. **Seborrheic Dermatitis:** A severe form of dandruff, characterized by red, oily skin covered with flaky white or yellow scales.
4. **Infrequent Shampooing:** Not washing your hair regularly can allow oils and dead skin cells to build up on the scalp, potentially causing dandruff.
5. **Skin Conditions:** Psoriasis and eczema can lead to flaking and scalp irritation, mimicking dandruff symptoms.
6. **Product Sensitivity:** Some individuals may react negatively to certain hair care products, especially those containing harsh chemicals or strong fragrances, resulting in scalp irritation and dandruff.
7. **Diet:** Poor nutrition, particularly diets deficient in zinc, B vitamins, and certain fats, can contribute to dandruff.
8. **Hygiene:** Infrequent washing or inadequate rinsing of the scalp can lead to dandruff.
9. **Climate:** Weather conditions like cold, dry winters or humid summers can influence the severity of dandruff.
10. **Hormonal Changes:** Hormonal fluctuations, such as those during puberty or due to certain medical conditions, can increase oil production on the scalp, leading to dandruff.
11. **Genetics:** Some individuals are genetically predisposed to having an oilier scalp or being more prone to dandruff. [2]

Symptoms of Dandruff

1. **White Flakes:** Noticeable white or grayish flakes of dead skin on your scalp, hair, and shoulders.
2. **Itching:** Often accompanied by itching on the scalp, which can range from mild to intense.
3. **Dry Scalp:** The scalp may appear dry and can sometimes feel tight or irritated.

4. **Scalp Redness:** In some cases, dandruff can cause mild redness, especially if scratching occurs.
5. **Oily Scalp:** Dandruff can also occur on an oily scalp, where the flakes may appear greasier.
6. **Hair Texture Changes:** Dandruff can sometimes affect the texture of your hair, making it look dull or rough.
7. **Increased Shedding:** You may notice an increase in hair shedding due to scratching or weakened hair shafts.
8. **Fungal Odor:** In severe cases, a mild fungal odor may be present due to yeast-like fungi growth on the scalp.
9. **Persistent Symptoms:** Symptoms may come and go, with periods of worsening and improvement.
10. **Localized Patches:** Dandruff can occur in specific patches on the scalp rather than uniformly across it. [3]

Treatments for Dandruff

1. **Anti-Dandruff Shampoos:**
 - a. **Medicated Shampoos:** Containing active ingredients like zinc pyrithione, selenium sulfide, ketoconazole, or coal tar. These help reduce fungi or yeast on the scalp and decrease flaking.
 - b. **Tar-based Shampoos:** Coal tar helps slow down skin cell turnover, reducing flakiness and itching.
 - c. **Selenium Sulfide Shampoos:** These reduce cell turnover and may also have antifungal properties.
 - d. **Ketoconazole Shampoos:** Known for their antifungal properties, they can reduce fungi on the scalp.

2. **Natural Remedies:**



- a. Tea Tree Oil: Has antifungal properties that can help reduce dandruff.
 - b. Coconut Oil: Moisturizes the scalp and has antifungal properties.
 - c. Aloe Vera: Soothes scalp irritation and reduces flakiness.
 - d. Adjusting Hair Care Routine
 - Regular Washing: Helps remove excess oils and dead skin cells.
 - Avoiding Harsh Products: Certain hair products can irritate the scalp, exacerbating dandruff.
 3. Managing Stress: Stress can exacerbate dandruff, so stress-reduction techniques may help.
 4. Dietary Adjustments: A diet rich in zinc, B vitamins, and certain fats may promote a healthier scalp.
 5. Medical Treatments: In severe cases, a dermatologist may prescribe topical steroids or antifungal creams to reduce inflammation and yeast overgrowth. [1]
- Anti-Dandruff Shampoo: Targets dandruff and scalp health.
 - Anti-Frizz Shampoo: Reduces frizz and smoothens hair.
 - Clarifying Shampoo: Removes buildup from hair products and minerals.
 - Hydrating Shampoo: Moisturizes dry hair.
 - Curl-Defining Shampoo: Enhances natural curls.
 - Detox Shampoo: Cleanses deeply to remove impurities.
 - Anti-Hairfall Shampoo: Reduces hair fall.
 - Shampoo for Color-Treated Hair: Protects and prolongs hair color.
 - Dry Shampoo: Absorbs oil without water.
 - Shampoo for Damage Repair & Strengthening: Repairs and strengthens damaged hair.
 - Scalp-Care Shampoo: Focuses on scalp health.

Shampoo:

Shampoo is a hair care product, usually found in a viscous liquid form, but also available as solid bars. It's used by applying to wet hair, massaging into the scalp, and then rinsing out to clean the hair.

Types of Shampoo

Based on Need of Usage

- Volumizing Shampoo: Adds volume to hair.

Based on Consistency:

- Clear Liquid Shampoos: Transparent and lightweight.
- Liquid Cream Shampoos: Creamy texture, providing rich lather.
- Cream Shampoos: Thick and nourishing.
- Gel Shampoos: Gel-like consistency, often light and refreshing.



- Powder Shampoos: Dry powder form, typically used as a dry shampoo.
 - Aerosol Shampoos: Spray format, usually for dry shampoo.
 - Medicated Shampoos: Contains medicinal ingredients for specific scalp conditions.
 - Conditioner Shampoos: Combines cleansing and conditioning in one step.
2. Spreading: It should spread evenly on the scalp.
 3. Lather: It should create ample lather after application.
 4. Cleansing: It should effectively remove waste products like dead cells, dirt, sebum, and perspiration salts from the scalp.
 5. Residue-Free: It should not leave any film on the scalp.

Advantages of Shampoo

1. Cleaning: Removes dirt, debris, odors, and oil from hair.
2. Strengthening: Strengthens and moisturizes hair, helping to repair damage.
3. Treating Dandruff: Soothes dandruff symptoms, neutralizes causes, and washes away flakes.
4. Improving Hair Texture: Herbal shampoos enhance texture, reduce frizz, add shine, and smooth hair cuticles.
5. Preventing Flat Hair: Techniques like reverse shampooing can help prevent flat hair.
6. Maintaining Hair Color: Special shampoos can help maintain and prolong hair color.
7. Reducing Hair Loss: Clean, healthy scalps and follicles reduce the chance of hair loss.
8. Environmentally Friendly: Natural shampoos avoid polluting chemicals like phosphates and sulfates.
6. Rinsing: It should rinse out completely after washing.
7. Temperature Flexibility: It should lather well with both hot and cold water.
8. Ease of Combing: It should make hair easier to comb after use.
9. Texture: Hair should not feel hard or stiff after drying.
10. Luster: It should add shine to hair.
11. Fragrance: It should have a pleasant odor both before and after use.
12. Non-Irritating: It should not cause scalp irritation or itching.
13. Microbial Resistance: It should not encourage microbial growth.
14. Stability: It should have a stable shelf life of about two to three years.
15. Cost-Effective: It should be affordable. [4]

Ideal Properties of Shampoo

1. Viscosity: It should have the right viscosity for easy application.

Description of Ketoconazole

Ketoconazole shampoo is a highly effective antifungal treatment for scalp issues like dandruff and seborrheic dermatitis. It works by inhibiting



the production of ergosterol, a key component of fungal cell membranes, thereby suppressing fungal growth and causing cell death. This results in significant relief from symptoms such as itching, flaking, and irritation. The shampoo is applied to damp hair, massaged into the scalp to form a lather, and then thoroughly rinsed out after a few minutes. Usage typically ranges from two to three times per week, depending on the severity of the condition. While most users tolerate ketoconazole shampoo well, some may experience mild side effects like scalp dryness or itching. [5]



Fig. No. 1 Ketoconazole Shampoo

Ketoconazole 1% and Ketoconazole 2%

Ketoconazole shampoo is available in two concentrations: 1% and 2%. The 1% shampoo is available over-the-counter and is suitable for treating mild scalp issues and maintaining scalp health. The 2% shampoo, which is more potent and usually requires a prescription, is used for more severe conditions. Both concentrations help reduce dandruff by combating the bacteria, yeasts, and fungi that cause it. The 2% formulation is particularly effective in enhancing scalp microflora and reducing inflammation but may

have side effects such as itching, hair texture changes, and dry skin. The 1% shampoo is a good option for those with minor hair concerns and is freely accessible without a prescription. [5]

Assessment Criteria for Shampoo Containing 1% and 2% Ketoconazole

Physical Characteristics:

- **Appearance:** Both 1% and 2% ketoconazole shampoos should be clear, viscous solutions free of particulates, adhering to standard pharmaceutical guidelines for topical medicines. [6]
- **Color:** The color should remain consistent throughout the product's shelf life.
- **Odor:** Should have a distinctive yet non-offensive odor. Consistency in odor is crucial for consumer acceptance. [7]
- **pH:** The ideal pH range is 4.5 to 6.5, ensuring both scalp compatibility and product stability.
- **Viscosity:** Suitable viscosity aids in easy application and distribution on the scalp, impacting both effectiveness and usability. [8]

Assay and Content:

- **Active Ingredient Content:** The 1% shampoo should contain 1% w/v ketoconazole, while the 2% shampoo should contain 2% w/v ketoconazole.
- **Content Uniformity:** Consistency in dosage between batches is essential for both concentrations, typically verified using high-performance liquid chromatography (HPLC). [9]

Microbial Boundaries:

- **Microbial Contamination:** Products should meet acceptable limits for bacteria, yeast, and fungi, with total viable count tests ensuring less than 100 CFU/g as per the European Pharmacopeia for topical medicines.
- **Preservative Efficacy:** The formulation should include preservatives that maintain microbiological quality throughout the product's shelf life. [11]

Capacity to Foam and Resilience:

- **Foam Volume:** Adequate foaming ensures better spreadability and cleaning efficacy, evaluated through standardized foam volume tests.
- **Detergency:** The product's ability to remove debris, oils, and fungi from the scalp without causing excessive dryness or irritation.

Stability Studies:

- **Shelf Life:** Stability testing in varied temperature and humidity conditions is conducted according to ICH guidelines, monitoring parameters like viscosity, pH, and color over time. [12]
- **Packaging Stability:** Ensures the formulation does not react with packaging materials or degrade over time. [12]

Safety and Irritation Potential:

- **Skin Irritation Tests:** Both 1% and 2% shampoos are tested on human or animal models to ensure they do not cause skin irritation or allergic reactions, with extra attention given to the higher 2% concentration. [13]

- **Toxicity Testing:** Verifies that extended use does not result in adverse effects, especially for the higher 2% concentration.

Efficacy:

- **Antifungal Activity:** The effectiveness of 1% and 2% shampoos in treating fungal conditions like pityriasis versicolor, seborrheic dermatitis, and dandruff is tested. Research indicates that 2% ketoconazole is more effective for severe cases, while 1% is suitable for mild dandruff and maintenance. [14]
- **Clinical Evaluations:** Controlled studies assess reductions in fungal growth, scaling, and dandruff. [14]

User Experience:

- **Ease of Application and Rinsing:** Both 1% and 2% shampoos should be easy to apply and rinse off, leaving no residue on the scalp. User feedback is crucial for understanding real-world acceptability.
- **Hair Conditioning Effects:** The shampoos should not overly dry or damage hair, potentially incorporating conditioning agents to improve hair texture post-use.

Labeling and Regulatory Needs:

- **1% Shampoo:** Generally sold over-the-counter (OTC) for treating mild dandruff.
- **2% Shampoo:** Often regulated as a prescription-strength product due to its higher potency for more severe conditions.
- **Labeling:** Accurate labeling of dosage, indications, and precautions is essential for both concentrations.



Sensory Evaluation:

- **Texture and Aroma:** Consumer acceptance tests evaluate the shampoo's texture and aroma, as well as its general feel on the scalp and hair.

Adverse Effects of Shampoos Containing 1% and 2% Ketoconazole

1. Local Irritation:

- **Scalp Irritation:** Common adverse reaction for both 1% and 2% shampoos, including redness, stinging, tingling, or burning sensations. These effects are typically minor and temporary but may be more pronounced with the 2% formulation.
- **Contact Dermatitis:** Rare allergic reactions to ketoconazole or inactive ingredients, resulting in localized inflammation, swelling, and blistering. [16,17]

2. Affected Hair:

- **Hair and Scalp Dryness:** Regular use, especially of the 2% formulation, may lead to dryness due to alterations in natural scalp oils.
- **Changes in Hair Texture:** Some users report hair feeling more brittle or coarse.
- **Hair Discoloration:** Rare instances of hair color changes, particularly in gray or chemically treated hair, with a slightly higher risk for the 2% formulation. [18]

3. Allergic Reactions:

- **Hives, Rash, and Swelling:** Rare allergic reactions to ketoconazole or shampoo preservatives, including rash, hives, swelling

(especially of the face, tongue, or throat), and severe itching.

- **Severe Allergic Reactions (Anaphylaxis):** Rare but serious allergic reactions requiring immediate medical attention, with symptoms like breathing difficulties, extreme swelling, and dizziness. [19]

4. Eye Irritation:

- **Eye Contact Issues:** Both 1% and 2% shampoos can cause severe eye irritation if they accidentally come into contact with the eyes. Users should thoroughly rinse eyes with water if this occurs. [20]

5. Systemic Absorption (Rare):

- **Hormonal Effects:** Minimal systemic absorption of ketoconazole from shampoo, but excessive or extended use of the 2% formulation may pose a risk of systemic effects, such as suppression of steroid production.
- **Hepatotoxicity:** Extremely low risk of liver toxicity from topical ketoconazole use, but continuous use warrants caution in case of systemic absorption. [21]

6. Seldom Occurs Hair Shedding:

- **Telogen Effluvium:** Rare reports of significant hair shedding, particularly with the 2% shampoo, usually temporary and reversible once usage is stopped. [22]

7. Exacerbation of Pre-Existing Skin Diseases:

- **Worsening of Eczema or Psoriasis:**** Rare instances where ketoconazole shampoo,



especially the 2% formulation, exacerbates pre-existing skin conditions. [23]

Precautionary Actions

1. Avoid Contact with Eyes:

- Reason: Ketoconazole shampoo can cause severe eye irritation.
- Suggestion: Tilt your head back or use a washcloth to protect your eyes during application.

2. Patch Test:

- Reason: Some individuals may be allergic to ketoconazole or other shampoo ingredients.
- Suggestion: Apply a small amount to a patch of skin or scalp. Avoid use if redness, irritation, or itching occurs within 24 hours. [24]

3. Adhere to Suggested Usage Frequency:

- Reason: Overuse, particularly of the 2% shampoo, can cause dryness, irritation, or changes in hair texture.
- Suggestion: Use the 1% shampoo regularly, like twice a week for mild conditions, and the 2% shampoo as directed by a healthcare professional. [25]

4. Limit 2% Shampoo for Extended Use:

- Reason: Prolonged use of 2% ketoconazole shampoo may increase the risk of systemic absorption and rare hormonal side effects.
- Suggestion: Use the 2% shampoo for no more than four weeks unless advised otherwise by a physician. Switch to 1% for long-term maintenance. [26]

5. Monitor for Allergy or Irritation:

- Reason: Possible irritation, redness, or itching, especially in sensitive individuals.
- Suggestion: Discontinue use if severe irritation occurs and consult a doctor if symptoms persist or worsen. [27]

6. Alternate Treatment Plans:

- Reason: Combining the 2% formulation with a gentle, non-medicated shampoo helps avoid excessive dryness and irritation.
- Suggestion: Use ketoconazole shampoo on prescribed days and a non-medicated shampoo on other days. [28]

7. Avoid Use on Damaged or Inflamed Skin:

- Reason: Application on damaged or inflamed skin may exacerbate the condition.
- Suggestion: Avoid using the shampoo on open wounds or highly irritated areas. Allow the skin to heal before using.

8. Limit Sun Exposure:

- Reason: Ketoconazole can make the scalp more sensitive to sunlight.
- Suggestion: Use protective measures like wearing a hat or applying sunscreen to exposed areas after using the shampoo. [29]

9. Consult Healthcare Professional During Pregnancy or Nursing:**

- Reason: Safety during pregnancy and nursing is not fully established.



- Suggestion: Pregnant or nursing women should consult their doctor before using ketoconazole shampoo, especially the 2% concentration. [30]

10. Proper Storage:

- Reason: Improper storage can affect the shampoo's stability and efficacy.
- Suggestion: Store in a cool, dry place away from heat sources and direct sunlight, and keep out of reach of children. [31]

CONCLUSION:

Dandruff is a common scalp condition with a range of microbial and non-microbial causes. Its development is closely linked to the overgrowth of the *Malassezia* yeast, which disrupts scalp physiology and causes irritation. While non-microbial factors such as dry skin, seborrheic dermatitis, environmental conditions, and the use of certain cosmetic products also contribute to dandruff, the exact relationship between *Malassezia* and dandruff remains complex and debated. Several factors can worsen dandruff, including underlying skin conditions, hormonal changes, and poor hygiene. Typical symptoms include an itchy scalp, flaky skin, and, in some cases, a more severe, oily condition known as seborrheic dermatitis. For mild to moderate dandruff or scalp issues, 1% ketoconazole shampoo is often sufficient. It has fewer side effects and is more convenient for long-term use. The 2% ketoconazole shampoo, which requires a prescription, is recommended for more severe cases of seborrheic dermatitis or dandruff. However, due to its higher risk of irritation and the need for medical supervision, it should be used cautiously and for shorter treatment durations.

The choice between the 1% and 2% formulations depends on the severity of the scalp condition and the individual's tolerance for stronger treatments. In summary, ketoconazole shampoos, whether 1% or 2%, play a significant role in managing dandruff and related scalp conditions, but their use should be tailored to the specific needs and severity of the individual's condition.

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