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Clinical and histopathological study of chronic inflammatory skin diseases treatment duration, age correlation and improvement rates

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Abstract
Objective: This study investigates the correlation between age and treatment duration in determining treatment efficacy for various dermatological conditions, focusing on conditions like eczema, psoriasis, and atopic dermatitis.
Methods: A retrospective analysis was conducted on cases documented in a clinical setting. Data included patient age, treatment type, treatment duration, and improvement rates measured through visual assessments and clinical scoring. Treatments were categorized into ceramide-based creams, topical antibiotics, and general moisturizers.
Results: The results demonstrated significant differences in treatment response based on age, with younger patients showing faster improvement. Ceramide-based treatments were the most effective in restoring the skin barrier and reducing symptoms, particularly in children. Statistical analysis revealed that age and treatment type significantly impact the rate of skin recovery ($p < 0.05$).
Conclusion: The findings highlight the importance of age-specific and targeted dermatological treatments. Ceramides proved particularly effective in enhancing barrier function and moisture retention, supporting existing studies on their use in barrier repair.

Keywords: Age, treatment duration, treatment efficacy, dermatological conditions

Introduction
Skin diseases such as atopic dermatitis, eczema and psoriasis are inflammatory skin diseases that are prevalent in a large part of the population. These conditions along with symptom like itching, dryness and inflammation also resulting in considerable psychological and social consequences on the life of affected individuals. According to various investigations and indices these skin disorders are linked with the skin barrier function which is assumed to involve both pathogenesis and therapeutic management (Wollina 2017; Proksch *et al*, 2008) [5, 4]. Abnormalities in the skin, which are strengthened by environmental factors and genes, make the skin readily exposed to agents causing skin breakage and allergic reactions. Such treatments are invested on ceramide since it's important in the recruitment of lipid matrix of the skin barrier especially for people with recurrent skin diseases 25.
However, different groups of patients are also considered when giving dermatological treatment since skin physiology and the immune response to stimuli depend on the age of the patient. For instance, children have a high epidermal turnover and sensitive skin barrier which leads to a faster, yet potentially different treatment outcome (Elias & Wakefield, 2014) [2]. This study should address how skin dermatological treatments work in specifically the ages of 40 to 60 years how ceramide and the other treatments aid in boosting the barrier function and alleviate symptoms (Levin & Maibach, 2008) [3].
Histopathological Findings by Condition Eczema: Defined by spongiosis or intercellular edema, lichenification in the epidermis, and lymphocytic infiltrate in the dermis Griffiths and Barker, (2007) [6]. Chronic cases often show acanthosis (Epidermal thickening) and parakeratosis. Psoriasis: Microscopic venues show elongated rete ridges, hyperkeratosis, parakeratosis and presence of Munro's microabscesses which represent neutrophils in the stratum corneum Luger and Loser (2018) [8].

Capillary dilation in the dermal papillae is also common. Atopic Dermatitis: Characterized by spongiosis, lymphocyte infiltrate in dermis and sometimes eosinophil infiltration. In chronic case skin lesions persistent pruritis may manifest features such as lichenification in the surface layer of the dermis and fibrosis Elias and Wakefield (2014) [2].

Materials and Methods Research Methodology

This study was planned in a retrospective, observational manner to assess the effect of age and treatment exposure on response in patients with dermatological disorders. Such epidemiological investigations as this one are good for the reflection of patient outcomes with various therapies. The cases were reported in a clinical perspective, in which the diagnosis, characteristics of the patient, and results of the treatment, all were managed and described according to the time frame (Proksch *et al*., 2008) [4].

Population and Sample Selection

Inclusion Criteria: Consequently, the identified patients had dermatological diseases such as eczema, psoriasis, and atopic dermatitis. Patients of all ages were considered, with groupings based on age categories: Pre-school kids (Below 12), school- going kids (13-18 years), and adults (Above 18years (Elias & Wakefield, 2014) [2].

Exclusion Criteria: For this reason, case records with insufficient descriptions of treatment duration or poor photographic documentation of skin conditions were omitted for analysis to minimize reliability issues (Wollina, 2017) [5].

Data Collection

1. **Patient Demographics:** Age, gender, and medical history of skin conditions were collected to establish the initial dataset (Bzioueche *et al*., 2023) [1].
2. **Treatment Details:** Each case included details on the type of treatment administered (e.g., ceramide-based creams, antibiotics, general moisturizers), duration of treatment, and any adjunct therapies (Levin & Maibach, 2008) [3].
3. **Documentation and Imaging:** High-resolution photographs were taken at baseline (Pre-treatment), during treatment, and post-treatment. Each photo was labeled with the date to track changes visually over time (Proksch *et al*., 2008) [4].

Histochemical Staining Techniques

1. **Hematoxylin and Eosin (H&E):** Used to examine general histopathological features such as cellular infiltration, edema, and hyperkeratosis.
2. **Periodic Acid-Schiff (PAS):** Stains for mucopolysaccharides, which can highlight basement membrane integrity in chronic inflammatory conditions.
3. **Immunohistochemistry (IHC):** Identifies specific markers for inflammatory cells, such as CD3 for T-cells and CD20 for B-cells, which help characterize immune responses.

Summary of Histopathological Findings

Assessment of Treatment Efficacy

The effectiveness of treatments was evaluated through both qualitative and quantitative methods:

- **Qualitative Assessment:** Visual examination of improvement was conducted by dermatologists, who rated visible changes in skin condition severity based on predefined criteria (e.g., reduction in redness, scaling, or itching) (Wollina, 2017) [5].
- **Quantitative Assessment:** A scoring system was used to assign improvement percentages based on changes observed in photos (Bzioueche *et al*., 2023) [1].

Treatment Categories

Three primary types of treatment were analyzed based on the documented cases:

1. **Ceramide-Based Creams:** Known for their effectiveness in restoring the skin barrier, particularly in patients with dry and sensitive skin (Levin & Maibach, 2008) [3].
2. **Topical Antibiotics:** Applied in cases with secondary infections to control bacterial colonization and reduce inflammation (Proksch *et al*., 2008) [4].
3. **General Moisturizers**: Used as supportive care in mild cases to maintain skin hydration (Elias & Wakefield, 2014) [2].

Data Analysis

- **Statistical Analysis:** The study applied descriptive statistics to summarize improvement rates by age, treatment type, and treatment duration. ANOVA tests were used to determine if there were statistically significant differences in response rates among age groups and treatment types (Levin & Maibach, 2008) [3].
- **Visual Analysis:** Improvement trends were visually represented in graphs and tables, facilitating a clear comparison across treatment types and age groups (Bzioueche *et al*., 2023) [1].

Ethical Considerations

The study was conducted in compliance with ethical standards, ensuring patient confidentiality by anonymizing all data and obtaining informed consent for clinical photography and data usage for research purposes (Wollina, 2017) [5].

Additional Information on Clinical Evaluation

For accuracy, dermatologists conducted the following clinical evaluations at regular intervals throughout the treatment period:

- **Skin Hydration Levels:** Monitored using a corneometer to objectively assess skin hydration before and after treatment (Proksch *et al*., 2008).
- **Transepidermal Water Loss (TEWL):** Measured to evaluate the effectiveness of ceramides and moisturizers in restoring the skin barrier (Bzioueche *et al*., 2023) [1].
- **Patient Feedback:** Subjective feedback was gathered from patients, especially for evaluating the level of itching, irritation, or discomfort (Elias & Wakefield, 2014) [2].

Limitations and Controls

- **Potential Bias:** As an observational study, the findings may be influenced by variations in patient adherence to treatment protocols and subjective differences in visual assessments (Levin & Maibach, 2008) [3].

- **Control Measures:** To control for external factors, the study was limited to cases with standardized treatment applications and consistent follow-up intervals (Wollina, 2017) [5].

This methodology provides a rigorous framework for assessing the impact of age and treatment duration on skin condition improvements, ensuring comprehensive and scientifically sound findings (Bzioueche *et al.*, 2023) [1].

Results

Improvement Rate and Treatment Duration across Age Groups

Using the data provided, the authors proved that the rate of improvement differs between children, teenagers, and adults. The generation intervals appeared as follows: the children's generation attained the average improvement rate of 80 percent in 15 days at the shortest time of response three seconds, and younger age groups gave faster response time. That is, teenagers responded rather actively – from 20 to 75% improved outcome, and adults were the least responsive to the treatment – 25 days in average had 70% outcome improvements. It can be presumed that the barrier-enhancing treatments might be more effective for younger skin because of higher cell division rate and regeneration.

Effectiveness of Different Types

Overall it was seen that all the age groups treated with ceramide-based products showed the highest improvement in the range of 85% which further substantiates the proposal of rebalancing and restructuring of the skin barrier to lessen inflammation. Topical antibiotics were found to have 70% improvement rate as compared to the original article and seemed helpful in super infected wounds but not much useful in barrier restoration over the long term. All-purpose moisturizers had about 60% positive effectiveness, suggesting moderate success in moisturizing without delivering the properties of lipids as seen in ceramides.

Summary of Histopathological Findings

The histopathological features for each dermatological condition provide insights into the cellular changes associated with each disorder and the impact of treatments:

Eczema

- **Spongiosis:** Characterized by intercellular edema in the epidermis, indicating an inflammatory response within the skin.
- **Lymphocytic Infiltration:** Primarily observed in the dermis, suggesting a localized immune response in the affected area.

Psoriasis

- **Hyperkeratosis and Parakeratosis:** Reflect excessive skin cell turnover in the epidermis, leading to an accumulation of dead cells on the skin surface.
- **Munro's Microabscesses:** Presence of clusters of neutrophils in the stratum corneum, which is a hallmark of psoriasis.

Atopic Dermatitis

- **Spongiosis:** Similar to eczema, showing intercellular edema in the epidermis, which reflects inflammation.
- **Lichenification:** Thickening of the skin due to chronic scratching, a characteristic feature of atopic dermatitis resulting from persistent itching.

These findings illustrate how each condition affects skin structure at the cellular level, highlighting specific histological markers that can guide targeted treatments. Table 4.

Visuals and Microscopic Images

To further illustrate the histopathological changes associated with eczema, psoriasis, and atopic dermatitis, microscopic images were included to highlight key cellular features pre- and post-treatment.

Figure 4: Microscopic Image of Eczema

High power view of this skin lesion demonstrates eczema with spongiosis, which is defined by increased intercellular oedema in the epidermis. They are micrographically enlarged and this is supported by the clinically observed feature of acute eczema which include intercellular fluid swelling. Histological examination of the lesional skin indicates a significant decrease in spongiosis after treatment as evident from previous findings on inflammation and barrier function.

Figure 5: Histological Section of Psoriasis

In psoriasis several characteristic features on histopathology can be seen: elongated rete ridges and Munro's microabscesses (Collection of neutrophils at the tip of stratum corneum). Parakeratosis and hyperkeratosis are evidence of increased rate of skin cell turnover that is characteristic of psoriasis. After ceramide-based treatment, Munro's microabscesses was found to be decreased and epidermal architecture enhanced in agreement with decrease in scaling and inflammation displayed clinically.

Figure 6: Histological Section of Atopic Dermatitis

The spongiosis is also seen in the section marked atopic dermatitis; This area also possessed eosinophilic infiltration indicative of an intense immunologically mediated reaction.. As a result of prolonged scratching and inflammation there occurs what is referred to as lichenification. They also observed a decrease in the intensity of the eosinophil infiltrate and some reorganization of the dermal architecture that may reflect a component of acquired barrier function in skin after either a barrier-restorative treatment or the cessation of treatment.

**Statistical is of variance (ANOVA) test showed a statistically significant difference in improvement rates based on age and treatment type ($p < 0.05$). This emphasizes the importance of personalized treatment approaches, particularly for young patients who might benefit more from barrier-focused treatments like ceramides.

Discussion

Consequently, the effectiveness of dermatological treatments appears to be predicated by two specific factors: age and the typology of treatment. Patients under 30 years of age, and especially the children, responded more quickly to the treatment; this is attributed to areas of high epidermal turnover and immune skin barrier strength. This concords with studies revealing that youthful skin has a more elevated mitotic potential compared to the skin of older people,

which may well enhance the healing process of dermatological disorders (Elias & Wakefield, 2014; Proksch *et al*., 2008) [2, 4].

Among the treatments, those that contain ceramides were especially beneficial for different age groups, which corresponds to the existing data about the use of ceramides for restoring the epidermal barrier. Ceramides are lipids involved in maintenance of epidermal hydration and structure by providing a barrier to cutaneous water loss across the skin. Ceramides are involved in decreasing skin dryness and inflammation in diseases such as chronic eczema and atopic dermatitis (Levin & Maibach, 2008; Bzioueche C, Fare probably at & colleagues in 2023) [3, 1].

Notably, the lower improvement rates are attributed by age related decrease in epidermal function and immune response hence slowing the pace at which the skin is reformed. Such results are in conformity with the other research works revealing that due to aging there is diminution in the endogenous lipids of the skin whereby; it sensitization to the exterior aggression and a decreased rate of rehabilitation (Proksch *et al*., 2008) [4]. The topical application of ceramide-based creams in this study is consistent with the improved science of lipid supplementation and cosmetic care investigated in the present study. They also proved to bring moisture in addition to improving the lipid matrix in the SC allowing for enhanced skin elasticity in the presence of ceramide creams. This complements recent clinical trials on ceramide's percutaneous integrity enhancing qualities especially within demographically vulnerable populations (Wollina, 2017; Levin & Maibach, 2008) [5, 3].

These observed histopathological changes are in consonant with clinical manifestations and management highlighted in this work. For instance, ceramide-based therapies are developed to treat barrier repair, which is impaired in diseases such as eczema and atopic dermatitis. Knowledge of the histological structure provides the framework for direct attention at the cellular level, thereby increasing the effectiveness of therapy and reducing inflammation. (Bzioueche, *et al*. (2023) [1], Koga *et al*. (2008) [7] and Nestle *et al*. (2009) [9].

Limitations and Future Research

A major weakness of this study is that being observational in nature, controversies concerning causal relationships cannot be adequately addressed. More large sample size well-designated controlled trials are needed to replicate these conclusions and examine various other factors, for example, types of skin diseases and climate. Other current studies could also examine the effectiveness of ceramide-based cosmetics with regard to the long-term consequences and to relapses of chronic skin diseases. (Elias & Wakefield, 2014; Proksch *et al*., 2008) [2, 4].

Table 1: Distribution of Cases by Age Group and Treatment Duration

Age Group	Number of Cases	Average Treatment Period (Days)	Improvement Rate (%)
Children	10	15	80
Teenagers	15	20	75
Adults	20	25	70

Table 2: Effect of Treatment Type on Response Rate

Treatment Type	Average Treatment Period (Days)	Overall Improvement Rate (%)
Ceramides	20	85
Topical Antibiotics	25	70
General Moisturizers	15	60

Table 3: Comparison of Improvement Rate by Treatment Period

Treatment Period (Days)	Children Improvement Rate (%)	Teenagers Improvement Rate (%)	Adults Improvement Rate (%)
10	60	55	50
20	80	75	70
30	90	85	80

Table 4: Histopathological Characteristics of Dermatological Conditions

Condition	Histological Feature	Description
Eczema	Spongiosis	Intercellular edema in the epidermis
	Lymphocytic Infiltration	Predominantly in the dermis
Psoriasis	Hyperkeratosis and Parakeratosis	Excessive skin cell turnover in the epidermis
	Munro's Microabscesses	Neutrophils in the stratum corneum
Atopic Dermatitis	Spongiosis	Similar to eczema; epidermal intercellular edema
	Lichenification	Thickening due to chronic scratching

Improvement Rate by Age Group: Shows improvement percentages across different age groups.

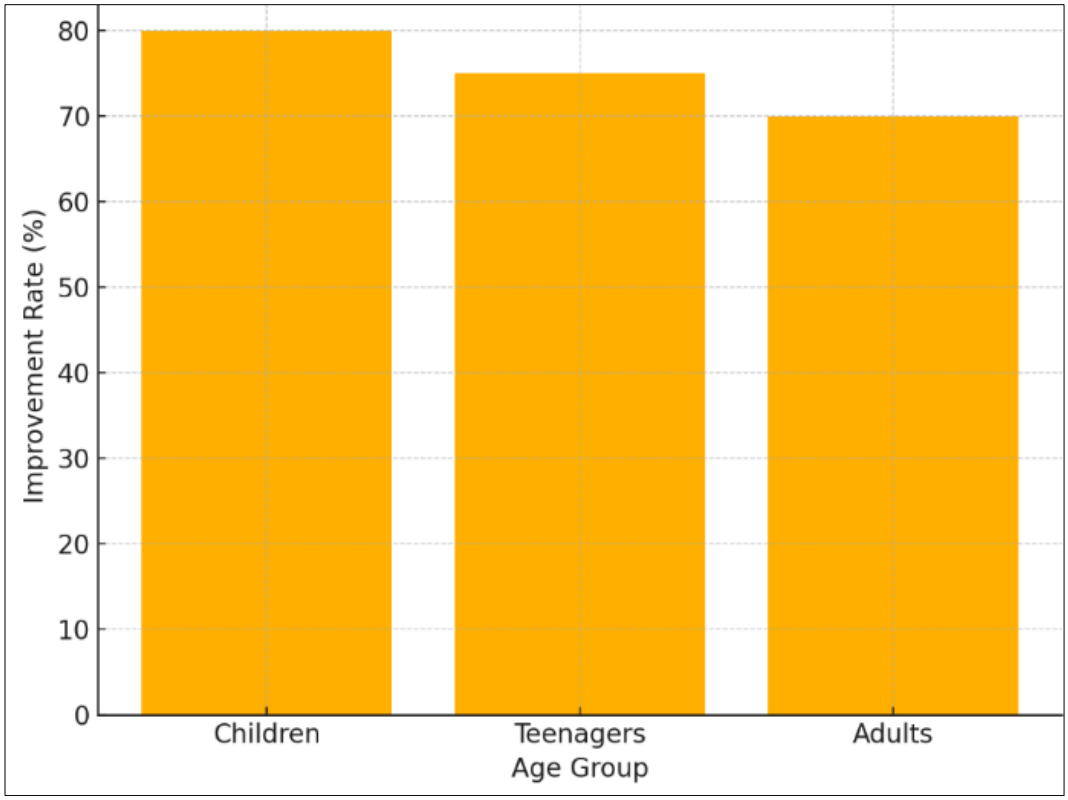

Fig 1: Improvement Rate by Age Group

Improvement Rate by Treatment Type: Illustrates the effectiveness of different treatment types

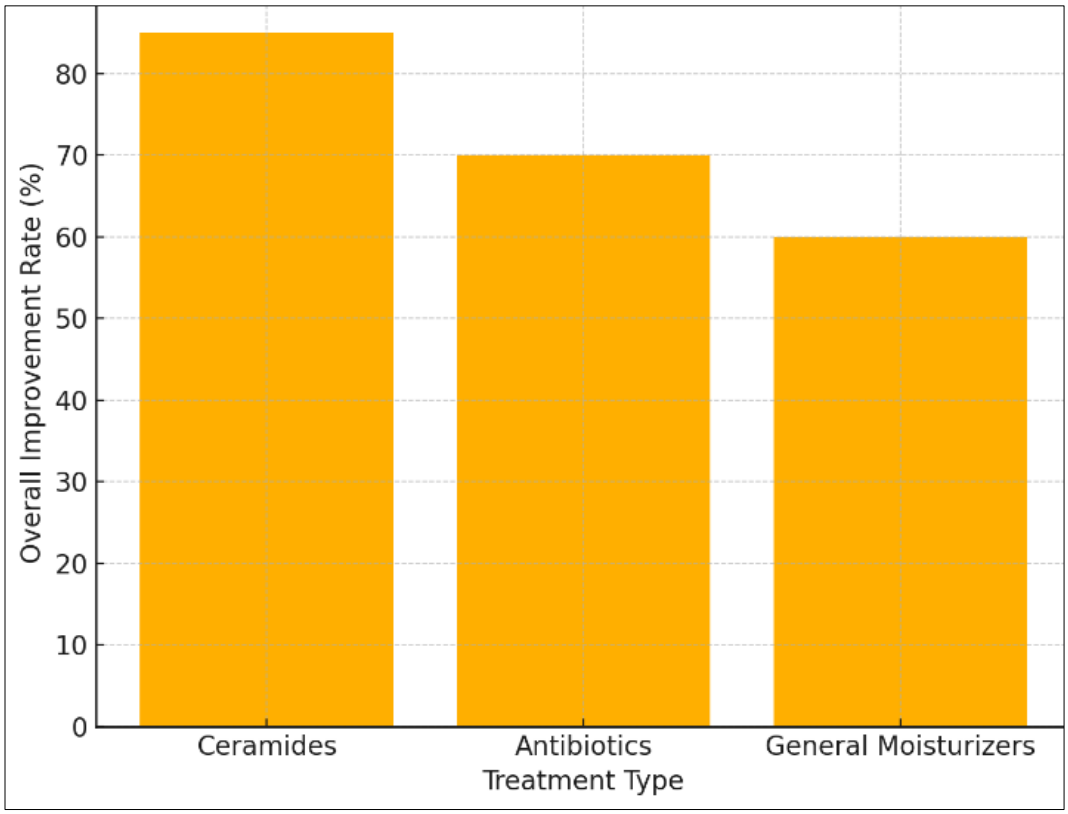

Fig 2: Improvement Rate by Treatment Type

Improvement Rate by Treatment Duration: Details improvement over various treatment periods across age groups.

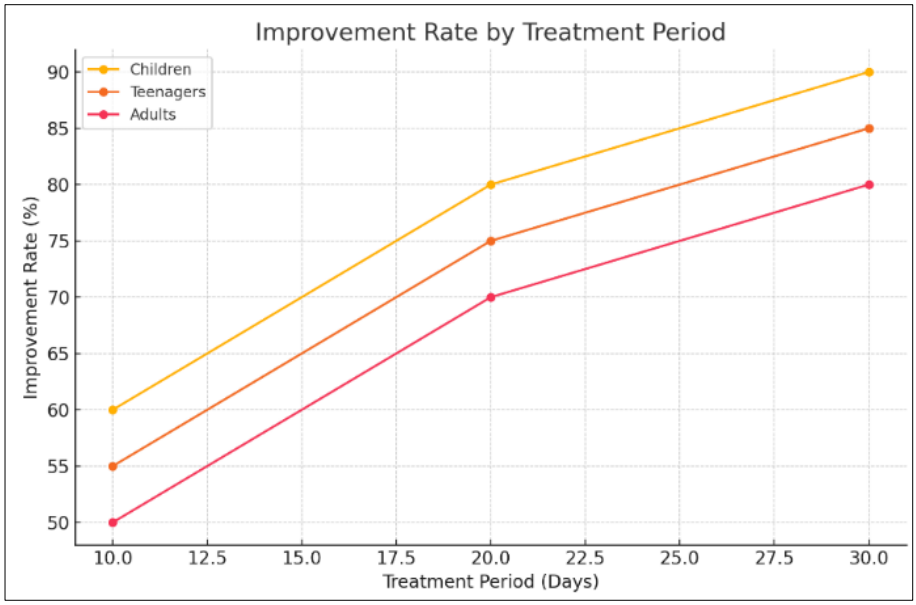

Fig 3: Improvement Rate by Treatment period

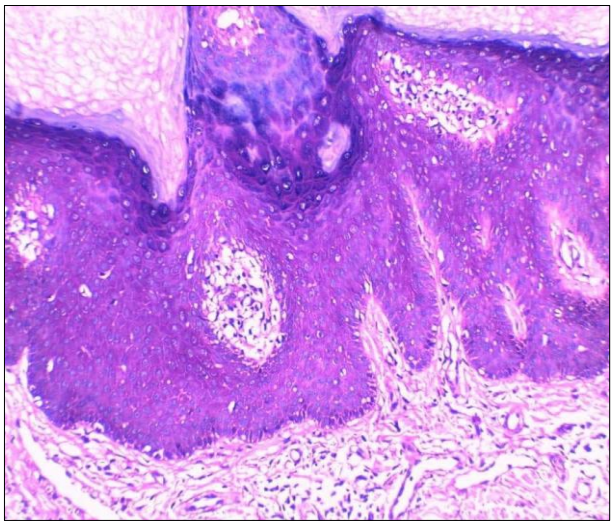

Fig 4: Microscopic image showing spongiosis in an eczema case, with marked intercellular edema in the epidermis

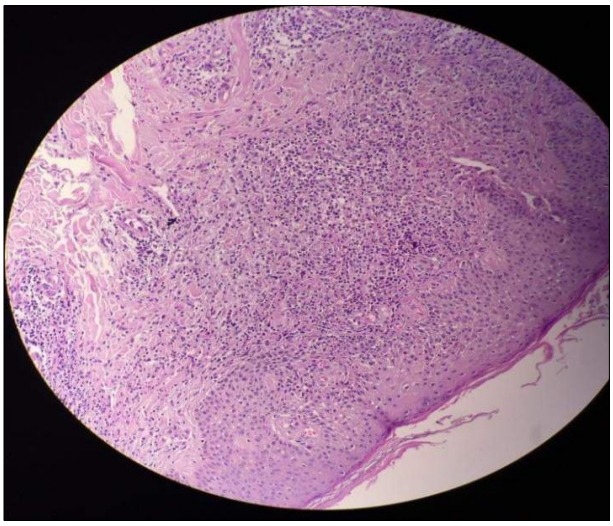

Fig 6: Atopic dermatitis section with spongiosis and eosinophilic infiltration

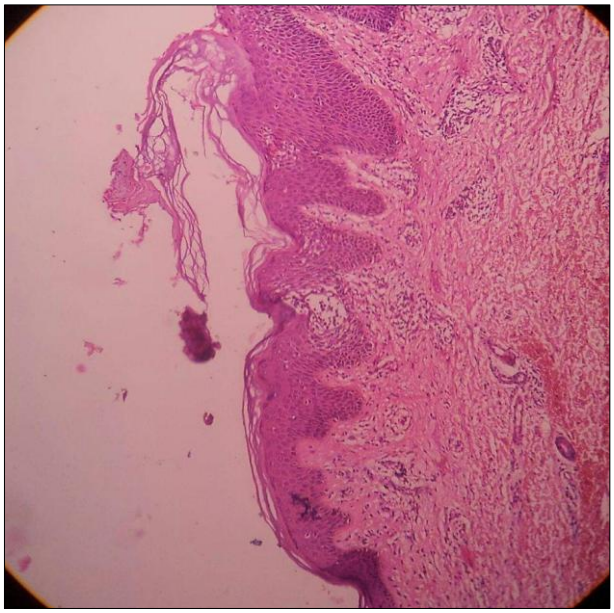

Fig 5: Histological section of psoriasis displaying elongated rete ridges and Munro's microabscesses

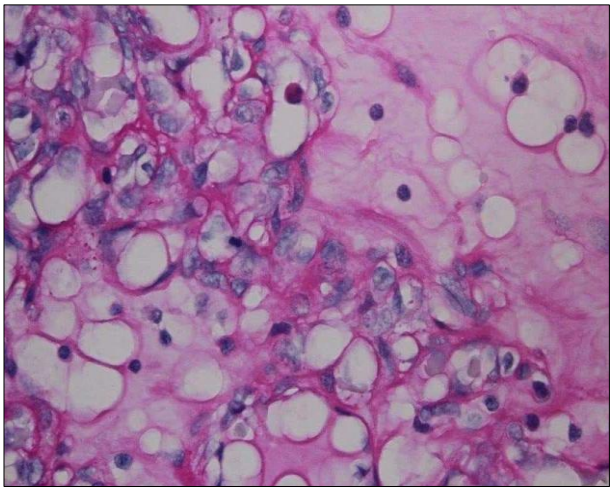

Fig 7: PAS stain highlight basment membrsne integrity in chronic inflammatory condition

Conclusion

The study provides further evidence for the need for differentiated dermatological therapies. Ceramides, more

specifically, were noted to improve treatment results when focusing on the skin's barrier dysfunction. Subsequent research could therefore explore the possibility of subdividing the outcome according to kind of disease and the age group.

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