A COMPARATIVE STUDY OF INTRALESIONAL PLATELET-RICH PLASMA AND INTRALESIONAL TRIAMCINOLONE ACETONIDE IN THE MANAGEMENT OF ALOPECIA AREATA

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INTRODUCTION

According to the World Health Organization (WHO), health is defined as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." [redacted] The disease typically presents as well-defined patches of hair loss and may occasionally progress to more severe forms such as alopecia totalis (complete loss of scalp hair) or alopecia universalis (loss of hair over the entire body) [2].

[redacted]

In recent years, platelet-rich plasma (PRP) therapy has emerged as a promising treatment option in dermatology. These growth factors play a crucial role in tissue repair, angiogenesis, and stimulation of hair follicle stem cells, thereby promoting hair growth [9].

Such studies help assess therapeutic efficacy, side effects, and overall patient outcomes, thereby guiding clinicians in selecting appropriate treatment modalities for patients with alopecia areata [7].

Epidemiology

Global Epidemiology

Alopecia areata is one of the most common causes of non-scarring hair loss worldwide. [redacted] Alopecia areata is also frequently associated with other autoimmune conditions such as thyroid disorders, vitiligo, type 1 diabetes mellitus, and systemic lupus erythematosus [2].

Indian Epidemiology

In India, alopecia areata is commonly encountered in dermatology outpatient departments and represents a significant proportion of cases of hair loss. [redacted] Associated autoimmune diseases such as thyroid disorders and vitiligo are also reported among Indian patients with alopecia areata [2].

AIMS AND OBJECTIVES

[redacted]

REVIEW OF LITERATURE

Alopecia Areata

Fig 1: Clinical presentation of Alopecia Areata

Alopecia areata is a chronic, immune-mediated disorder characterized by non-scarring hair loss involving the scalp and other hair-bearing areas of the body. [redacted] In addition to its cutaneous manifestation, it carries considerable cosmetic and psychological significance, especially in younger individuals [14].

Etiology of Alopecia Areata

Genetic Factors

Alopecia areata is considered a multifactorial disorder in which genetic susceptibility plays a major role in determining who develops the disease. [redacted] Thus, heredity is important not only in disease initiation but also in its clinical behaviour [17].

Autoimmune Mechanisms

Autoimmune mechanisms are central to the development of alopecia areata and are regarded as the principal pathogenic basis of the disease. [redacted]

[redacted]This immune basis also explains why the disease may coexist with other autoimmune disorders and why immunomodulatory therapy forms the cornerstone of treatment [19].

Environmental Triggers

Environmental triggers are believed to play an important role in precipitating alopecia areata in genetically susceptible individuals. [redacted]Because these exposures vary widely among individuals, the environmental contribution to alopecia areata is often complex and difficult to quantify [21].

Psychological Stress

Psychological stress is widely regarded as an important contributing factor in alopecia areata and is frequently reported around the time of disease onset or exacerbation. [redacted]

[redacted]

In dermatology practice, this aspect is important because the impact of alopecia areata extends beyond the scalp and involves the emotional and psychosocial dimensions of illness [23].

Pathogenesis of Alopecia Areata

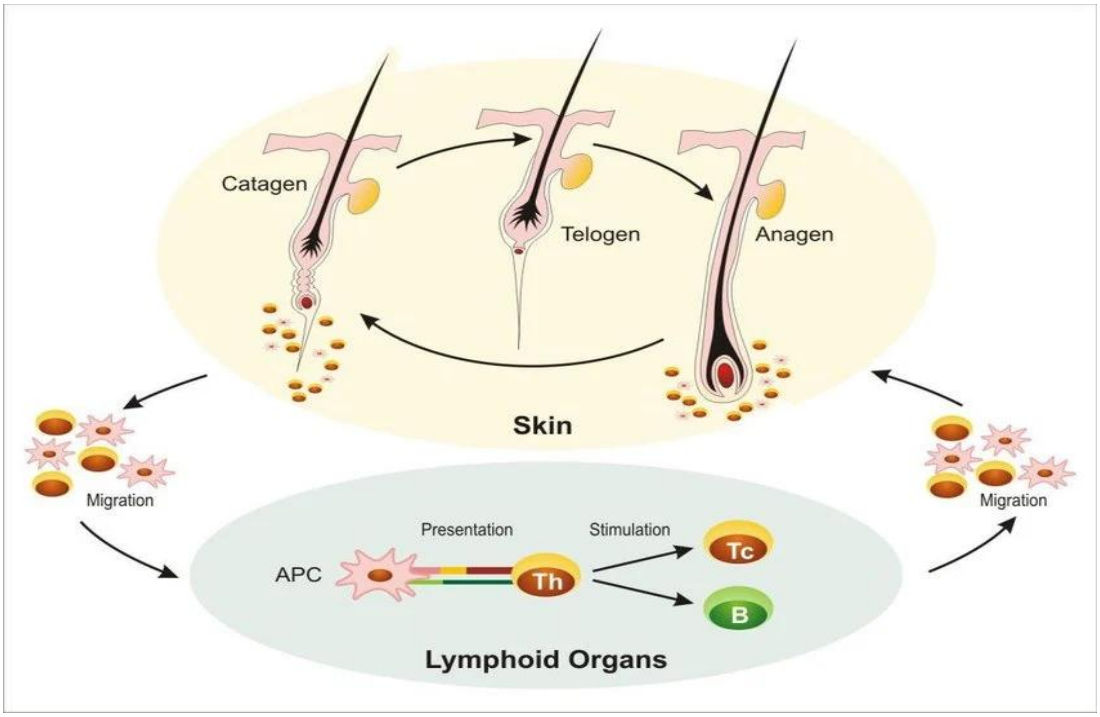

Fig 2: Pathogenesis of Alopecia Areata

Immune Privilege of Hair Follicle

The concept of immune privilege is central to understanding the pathogenesis of alopecia areata. [redacted]

[redacted]

This explains why alopecia areata presents as non-scarring hair loss with retained regrowth potential [14].

Role of T-Lymphocytes

T-lymphocytes play the principal effector role in the pathogenesis of alopecia areata. [redacted]

The persistence or recurrence of T-cell activity determines whether the disease remains limited or becomes chronic and extensive [25].

Cytokines and Inflammatory Mediators

Cytokines and inflammatory mediators are crucial molecular components in the pathogenesis of alopecia areata because they sustain and amplify the immune response directed against the hair follicle. [redacted]

[redacted]

Cytokine-driven inflammation is therefore not a secondary feature, but an active mechanism through which follicular dysfunction is maintained [29].

Anatomy of the Hair Follicle

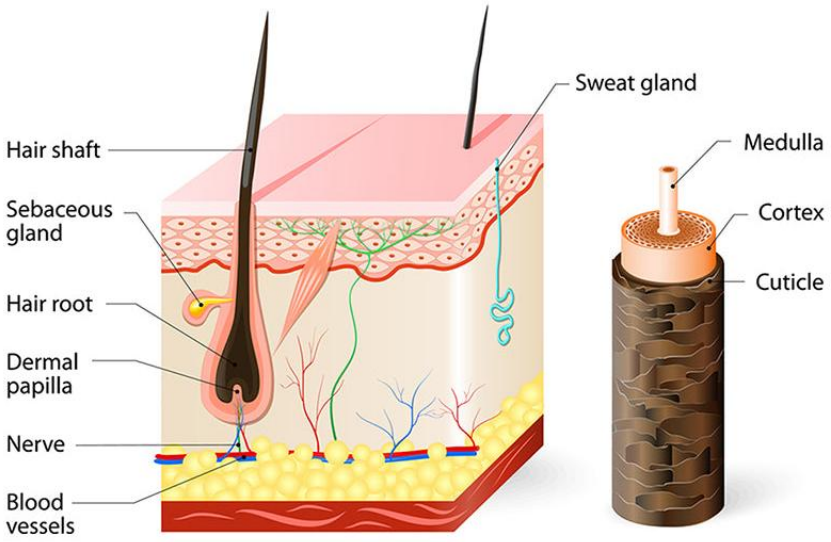

Fig 3: Anatomy of the Hair Follicle

Structural Anatomy of the Hair Follicle

The hair follicle is a highly specialized epithelial structure of the skin responsible for the formation, growth, and anchorage of hair. [redacted]

[redacted]

The outer root sheath surrounds the follicle and is continuous with the epidermis, while the inner root sheath helps mold and support the developing hair shaft [31].

Hair Growth Cycle

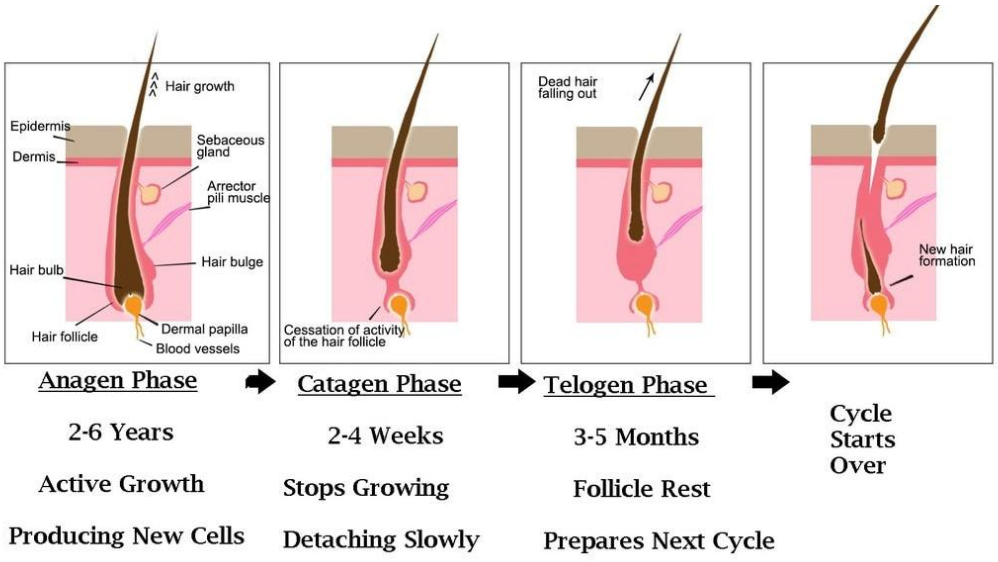

Fig 4: Hair Growth Cycle

Anagen Phase

The anagen phase represents the active growth stage of the hair follicle and is the longest period in the hair growth cycle. [redacted]

[redacted]

In conditions such as alopecia areata, immune-mediated attacks are mainly directed against anagen follicles, resulting in abrupt interruption of hair growth and subsequent shedding [34].

Catagen Phase

The catagen phase represents the transitional stage between active hair growth and the resting phase of the follicle. [redacted]

Only a small proportion of hair follicles are normally in catagen at any given time [36].

Telogen Phase

The telogen phase represents the resting stage of the hair growth cycle, during which the follicle remains inactive and no new hair production occurs. [redacted]

The balance between anagen and telogen phases therefore plays a critical role in maintaining normal hair density [33].

Clinical Features of Alopecia Areata

Patchy Alopecia Areata

Fig 5: Patchy Alopecia Areata

Patchy alopecia areata is the commonest clinical presentation of alopecia areata and is usually the initial form in which the disease is recognized.

The course is therefore often unpredictable [38].

Alopecia Totalis

Fig 6: Alopecia Totalis

Alopecia totalis is an advanced clinical form of alopecia areata in which there is complete or nearly complete loss of hair from the scalp.

Psychological distress is

especially pronounced in alopecia totalis because complete scalp hair loss produces a major cosmetic change and often affects body image, social confidence, and emotional well-being [2].

Alopecia Universalis

Alopecia universalis is the most extensive clinical form of alopecia areata and is characterized by complete loss of hair from the scalp as well as the entire body. [redacted] Nail involvement may coexist in some patients and may further indicate severe disease activity [40].

Ophiasis Pattern

Ophiasis is a distinctive clinical pattern of alopecia areata in which hair loss occurs in a band-like distribution along the peripheral scalp, especially the occipital and temporoparietal regions. [redacted]

[redacted]

Nail Changes in Alopecia Areata

Nail Involvement in Alopecia Areata

Nail changes are a recognized clinical association in alopecia areata and may be seen in a proportion of affected patients, particularly in those with extensive, chronic, or early-onset disease. [redacted] Their presence should prompt careful clinical assessment because they may coexist with extensive scalp disease such as alopecia totalis or alopecia universalis [42].

Associated Diseases and Comorbidities in Alopecia Areata

Alopecia areata is not merely a localized disorder of hair loss but a condition that may coexist with several systemic and cutaneous disorders, particularly those related to immune dysregulation. [redacted]

[redacted] Their presence also indicates the need for a more comprehensive clinical approach rather than viewing alopecia areata as an isolated cosmetic problem [45].

Prognostic Factors in Alopecia Areata

Prognostic factors in alopecia areata are important because they help predict the likely course of the disease, response to treatment, possibility of recurrence, and chances of long-term regrowth. [redacted] Prognostic factors therefore assist both in understanding disease severity and in setting realistic treatment expectations [48].

Differential Diagnosis of Alopecia Areata

The differential diagnosis of alopecia areata is important because several disorders can present with localized or diffuse hair loss and may resemble it clinically. [redacted]

[redacted]

Thus, the differential diagnosis depends on recognizing both the characteristic features of alopecia areata and the distinguishing features of other disorders [51].

Investigations in Alopecia Areata

Investigations in alopecia areata are undertaken to support the clinical diagnosis, assess disease extent, identify associated conditions, and exclude other causes of hair loss. [redacted]

[redacted]

Dermoscopy has become a valuable office-based tool in the evaluation of alopecia areata, while photographic documentation is helpful for monitoring treatment response over time [53].

Diagnostic Tools in Alopecia Areata

Dermoscopy

Dermoscopy is an important non-invasive diagnostic tool in alopecia areata and has become highly useful in routine dermatology practice for evaluating hair and scalp disorders. [redacted] In addition, it helps distinguish alopecia areata from trichotillomania, tinea capitis, androgenetic alopecia, and scarring alopecias, each of which shows different trichoscopic patterns [55].

SALT Score (Severity of Alopecia Tool)

The SALT score, or Severity of Alopecia Tool, is a standardized clinical method used to quantify the extent of scalp hair loss in patients with alopecia areata. [redacted]

[redacted]In therapeutic studies, including those comparing different treatment modalities, the SALT score is especially valuable because it provides a uniform and widely accepted outcome measure [58].

Principles of Management of Alopecia Areata

Management of alopecia areata is based on a set of clinical principles aimed at controlling disease activity, promoting hair regrowth, preventing progression where possible, and reducing the psychological burden associated with visible hair loss. [redacted]Psychological support and reassurance are also essential components of management, as emotional distress frequently accompanies even limited disease [61].

Treatment Modalities for Alopecia Areata

Topical Therapies

Topical therapies are commonly used in alopecia areata, especially in patients with limited scalp involvement, early disease, pediatric age group, or in those who are not suitable candidates for invasive treatment. [redacted] Because alopecia areata has an unpredictable course, response to topical treatment may be slow and requires regular follow-up [65].

Systemic Therapies

Systemic therapies are considered in alopecia areata when the disease is extensive, rapidly progressive, recurrent, or resistant to local treatment. [redacted]

[redacted]

In addition to therapeutic benefit, the clinician must consider patient tolerance, comorbid illness, and the practical need for clinical and laboratory monitoring during treatment [67].

Immunotherapy

Immunotherapy is an established treatment modality in alopecia areata, particularly in patients with extensive, chronic, or treatment-resistant disease. [redacted]

Because of the need for sustained application and follow-up, patient motivation and counseling are important components of successful therapy [11].

Intralesional Therapies

Intralesional therapies are among the most important treatment modalities in alopecia areata, particularly for localized patchy disease involving a limited area of the scalp. [redacted]

[redacted]

Because injections are given at regular intervals, treatment response can be followed closely through clinical examination, photography, and scoring methods such as the SALT score [70].

Intralesional Corticosteroid Therapy in Alopecia Areata

Intralesional corticosteroid therapy is one of the most important and widely accepted treatment options for localized alopecia areata, particularly in adults with patchy scalp involvement. [redacted]

Repeated sittings are usually required at intervals, and response is assessed clinically by patch size, density of regrowth, and objective tools such as SALT scoring when applicable [14].

Triamcinolone Acetonide

Pharmacology

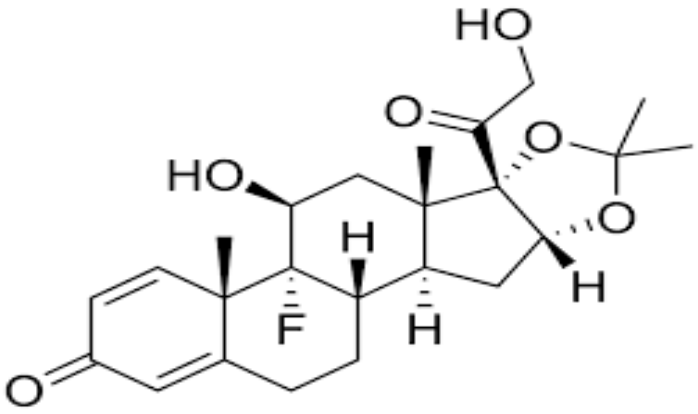

Fig 7: Molecular Formula of Triamcinolone Acetonide

Triamcinolone acetonide is a synthetic corticosteroid widely used in dermatology because of its potent anti-inflammatory and immunosuppressive properties. [redacted] The formulation is usually a suspension, which supports slow local release and sustained action after injection [14].

Mechanism of Action

Triamcinolone acetonide acts in alopecia areata primarily by suppressing the immune-mediated inflammatory process responsible for hair follicle dysfunction. [redacted]

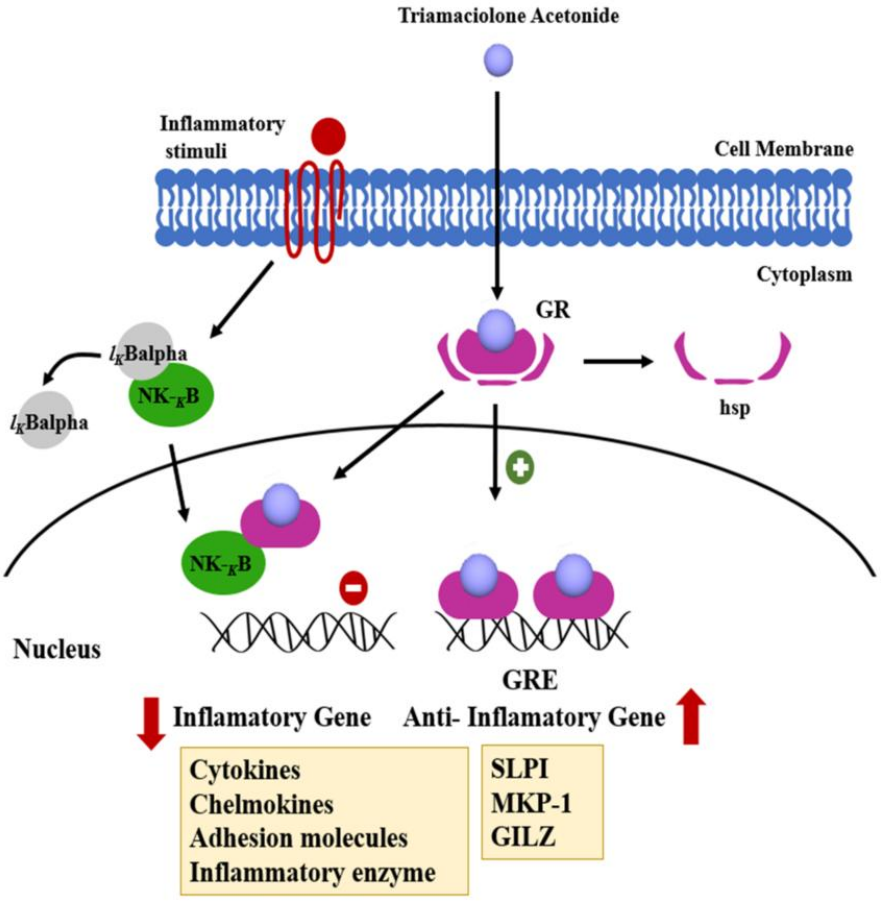

Fig 8: Mechanism of Action of Triamcinolone Acetonide

Dosage and Administration

Triamcinolone acetonide in alopecia areata is commonly administered by intralesional injection directly into the affected patch of hair loss. [redacted] Careful injection depth and spacing are essential because incorrect placement may reduce efficacy or increase local complications [77].

Therapeutic Response

The therapeutic response to intralesional triamcinolone acetonide in alopecia areata is generally assessed by visible hair regrowth, reduction in patch size, improvement in hair density, and objective scoring methods such as the SALT score. [redacted]

[redacted]

[redacted]

[redacted]Therefore, therapeutic success should be interpreted as meaningful clinical improvement rather than guaranteed permanent cure [11].

Adverse Effects

Although intralesional triamcinolone acetonide is effective in localized alopecia areata, it may produce adverse effects, most of which are local rather than systemic because the drug is delivered directly into the lesion. [redacted]

[redacted]

[redacted]Awareness of adverse effects is important because they influence technique, spacing of injections, concentration selection, and patient counseling before therapy is started [80].

Platelet Rich Plasma (PRP)

Platelet rich plasma is an autologous blood-derived biological product containing a platelet concentration higher than that found in normal circulating blood. [redacted]

In alopecia areata, PRP is usually delivered intralesionally, thereby combining direct local administration with regenerative signaling [82].

Preparation of Platelet Rich Plasma

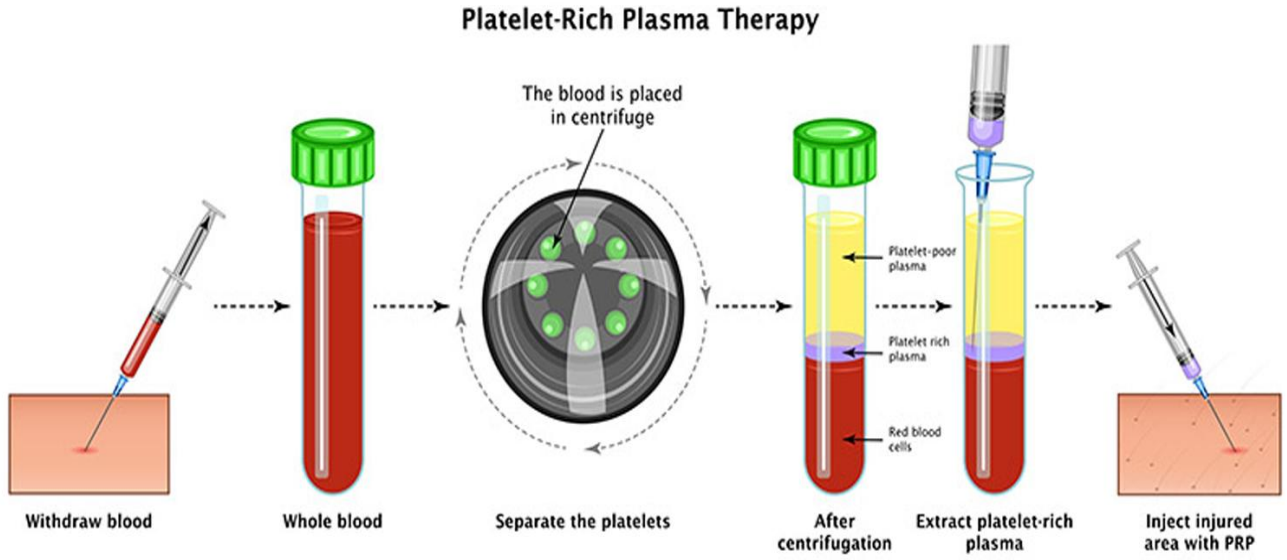

Fig 9: Platelet Rich Plasma

Preparation of platelet rich plasma is an important procedural step because the quality, concentration, and biological activity of the final product depend upon correct collection, separation, and handling of blood components.

In the synopsis you provided, PRP preparation involved withdrawal of blood into a sodium citrate vacutainer, centrifugation at 1500 rpm for 15 minutes, transfer of the upper layer containing buffy coat and plasma into another vacutainer without anticoagulant, and a second centrifugation at 2500 rpm for 10 minutes, after which the lower one-third containing PRP was used [83].

Biological Components and Growth Factors of Platelet Rich Plasma

Platelet rich plasma is biologically important because it contains concentrated platelets suspended in plasma along with several active molecular substances that contribute to tissue repair, regeneration, and cellular signaling.

[redacted]Thus, PRP acts as a biologically enriched preparation capable of delivering multiple regenerative signals simultaneously [70].

Mechanism of Action of PRP in Hair Growth

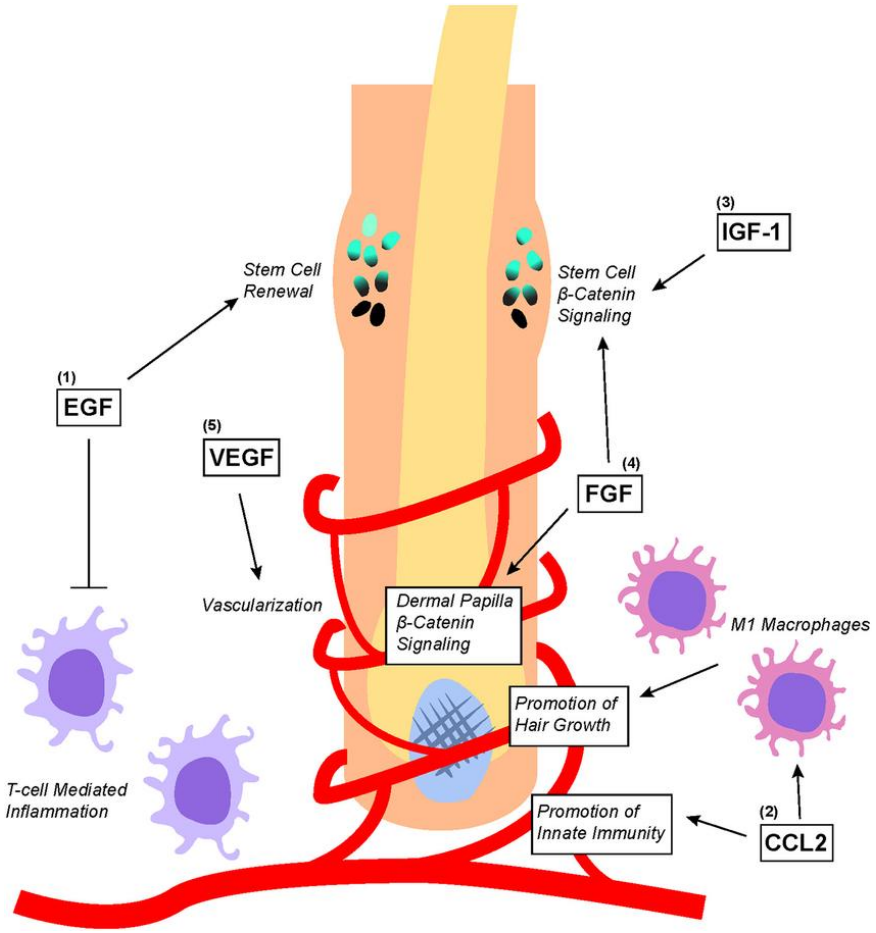

Fig 10: Mechanism of Action of PRP in Hair Growth

Platelet rich plasma promotes hair growth through a regenerative and biologically stimulatory mechanism that acts on the hair follicle and its surrounding microenvironment. [redacted]

[redacted] By improving cellular signaling, tissue nutrition, and local repair processes, PRP may help prolong the anagen phase and strengthen regrowth from follicles that remain structurally intact [86].

PRP Therapy in Dermatology

Platelet rich plasma therapy has emerged as an important biological treatment modality in dermatology because it is based on the use of autologous blood components with regenerative potential. [redacted] However, response may vary depending on disease type, preparation method, and treatment protocol [86].

PRP Therapy in Alopecia Areata

Indications

Platelet rich plasma therapy has emerged as a useful therapeutic option in alopecia areata, particularly in selected patients where localized biological stimulation of the hair follicle is desirable. [redacted] In the present topic, PRP is particularly relevant because it is being evaluated directly against intralesional triamcinolone acetonide, indicating its growing place in comparative dermatological therapeutics [83].

Advantages

Platelet rich plasma therapy offers several advantages in alopecia areata because it combines local administration with regenerative biological action. [redacted]

[redacted] Its growing interest in alopecia areata is also supported by the possibility that it addresses both regenerative and supportive aspects of follicular recovery [85].

Limitations

Despite its growing use, platelet rich plasma therapy in alopecia areata has several limitations that must be recognized before it is adopted as a routine treatment choice. [redacted] The cost of preparation equipment and procedural time may also limit accessibility in some settings [7].

Comparison of Intralesional PRP and Intralesional Triamcinolone in Alopecia Areata

Intralesional platelet rich plasma and intralesional triamcinolone acetonide are both important local treatment modalities used in alopecia areata, especially in patients with localized patchy disease. [redacted]

[redacted]

Thus, the comparison between these therapies is not merely one of efficacy, but also of mechanism, preparation, safety, and practical applicability [7].

Assessment of Treatment Response in Alopecia Areata

SALT Score Evaluation

Assessment of treatment response in alopecia areata requires objective and reproducible methods so that baseline severity and post-treatment improvement can be compared accurately. [redacted]

[redacted]

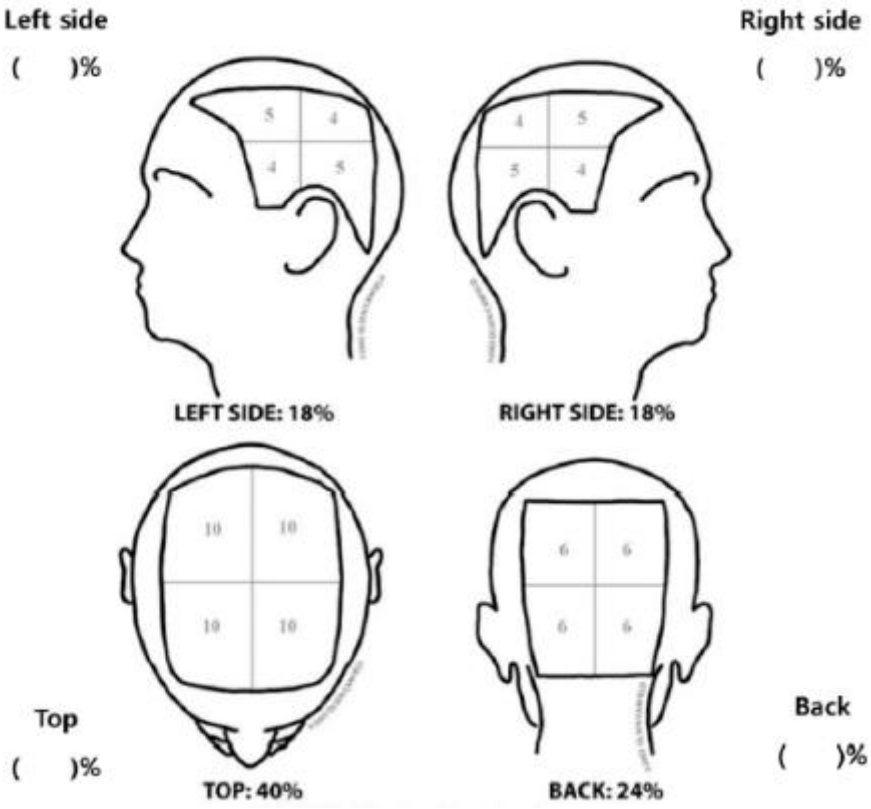

Fig 11: SALT Score Evaluation

Hair Regrowth Grading

Hair regrowth grading is an important clinical method used to assess treatment response in alopecia areata by evaluating the visible extent and quality of new hair growth within affected patches.

[redacted]

[redacted]

Initial regrowth may appear as fine, short, lightly pigmented hairs, which may later thicken and regain terminal characteristics [92].

Photographic Assessment

Photographic assessment is a valuable method for evaluating treatment response in alopecia areata because it provides visual documentation of the scalp before, during, and after therapy. [redacted]

- Photographs provide permanent visual documentation of disease status

Safety and Adverse Effects of Intralesional Therapies

Intralesional therapies are an important part of the management of localized alopecia areata because they permit direct delivery of therapeutic agents into the affected skin with relatively limited systemic exposure. [redacted] Therefore, safety assessment must include both medical and cosmetic considerations [95].

Rationale for the Present Study

Alopecia areata is a common non-scarring disorder of hair loss with an autoimmune basis and an unpredictable clinical course. [redacted]

[redacted]

In patchy alopecia areata, where both therapies can be applied directly into lesions, such comparison may help determine which approach provides better improvement with acceptable safety [81].

Research Studies

[redacted] **(2026)** evaluates the therapeutic efficacy of intralesional triamcinolone acetonide alone versus its combination with cryotherapy in patients presenting with limited patchy alopecia areata. The authors employ objective clinical parameters including extent of hair regrowth, reduction in patch size, and overall treatment response over a defined follow-up period. [redacted]

[redacted] **(2025)** evaluates the optimal concentration of intralesional triamcinolone acetonide in the management of alopecia areata, with a focus on balancing therapeutic efficacy and adverse effects. [redacted]

[redacted]

(2025) reviews synthesized current understanding of alopecia areata from clinical, immunological, and genetic perspectives, providing a strong theoretical framework for therapeutic comparisons. [redacted]

(2025) examines the inflammatory signatures and biological markers associated with platelet-rich plasma therapy in hair regrowth, providing important insights into its role in alopecia areata. [redacted]

[redacted]

[redacted] **(2025)** reviews provided an updated understanding of the molecular mechanisms and clinical applications of platelet-rich plasma across various medical fields, including dermatology. [redacted]

[redacted] **(2024)** reviews discussed triamcinolone acetonide in detail, including its mechanism of action, pharmacokinetics, and clinical applications. [redacted]

[redacted] **(2023)** reviews provided a comprehensive overview of current and emerging therapeutic options in alopecia areata, with particular emphasis on comparing conventional and newer treatment modalities. [redacted]

[redacted] **(2023)** reviews examined the adverse effects associated with corticosteroid therapy, providing important insights into the limitations of intralesional triamcinolone in alopecia areata. [redacted]

[redacted] **(2023)** examined the cellular and molecular mechanisms underlying platelet-rich plasma therapy in dermatology, with particular emphasis on its application in hair disorders such as alopecia areata. [redacted]

[redacted] **(2022)** reviews and meta-analysis evaluate the clinical efficacy of platelet-rich plasma in alopecia areata with emphasis on standardized outcome measures and comparative effectiveness. [redacted]

[redacted] **(2022)** reviews focused on the clinical application and therapeutic potential of platelet-rich plasma in hair regrowth, providing detailed insights into its role in conditions such as alopecia areata. [redacted]

[redacted]

[redacted] **(2021)** reviews evaluated various intralesional agents used in dermatology, including corticosteroids and platelet-rich plasma, highlighting their advantages and limitations. [redacted]

[redacted] **(2020)** evaluated the efficacy of intralesional platelet-rich plasma versus intralesional triamcinolone acetonide in patients with alopecia areata, making it highly relevant to comparative clinical research. [redacted]

[redacted] **(2020)** evaluated the role of platelet-rich plasma in hair disorders, comparing its efficacy with established treatments such as minoxidil, finasteride, and stem cell-based therapies. [redacted]

[redacted] **(2017)** focused on the importance of objective outcome measures in alopecia areata research and emphasizes standardized methods for assessing treatment response. [redacted]

[redacted] **(2016)** introduced the updated SALT II scoring system, a refined version of the Severity of Alopecia Tool used to assess scalp hair loss in patients with alopecia areata. [redacted]

[redacted]

[redacted] **(2015)** randomized placebo-controlled trial investigates the efficacy of platelet-rich plasma in promoting hair regrowth, providing foundational clinical evidence for its application in hair loss disorders. [redacted]

[redacted] **(2015)** provided a detailed account of the collection, processing, and preparation of human blood components, offering critical technical insights relevant to platelet-rich plasma therapy. [redacted]

[redacted]

[redacted] **(2014)** reviews outlined the principles and methods of preparation of platelet-rich plasma, providing essential insights into factors that influence its clinical efficacy. [redacted]

[redacted] **(2010)** reviews provided a detailed overview of the use of intralesional corticosteroids, particularly triamcinolone acetonide, in the treatment of alopecia areata. [redacted]

[redacted] **(2008)** explored the role of platelet-derived growth factors (PDGFs) in physiological processes and their therapeutic implications, providing a molecular basis for the use of platelet-rich plasma in regenerative medicine. [redacted]

MATERIALS AND METHOD

Study Design: Cohort Study

Study Setting: [redacted]

Study Units: [redacted]

Duration of Collection: [redacted]

Duration of Report Writing: [redacted]

Sample Size: [redacted]

Total Sample Size : [redacted]

Sampling: [redacted]

Inclusion Criteria

[redacted]

Exclusion Criteria

Methodology

Ethical Approval and Institutional Permission

Study Population and Patient Enrollment:

Allocation of Study Groups: [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Treatment Procedure

Group A: Intralesional Platelet Rich Plasma (PRP) Therapy: [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

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[redacted]

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[redacted]

Group B: Intralesional Triamcinolone Acetonide Therapy: [redacted]

[redacted]

[redacted]

[redacted]

Follow-up and Documentation: [redacted]

[redacted]

Assessment of Treatment Response

[redacted]

[redacted]

- [redacted]
- [redacted]
- [redacted]
- [redacted]

[redacted]

[redacted]

Severity of Alopecia Tool score: [redacted]

[redacted]

Statistical Analysis

Data Entry and Data Management: [redacted]

Descriptive Statistical Analysis: Descriptive statistical methods were used to summarize and present the baseline characteristics of the study participants. Descriptive statistics helped in providing an overall understanding of the demographic and clinical profile of the study population.

[redacted]

Inferential Statistical Analysis: [redacted]

Level of Statistical Significance: [redacted]

[redacted]

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