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RECENT DEVELOPMENTS IN THE TREATMENT OF SCALP PSORIASIS: A REVIEW

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ABSTRACT: Psoriasis a kind of skin condition which is said to be a type of autoimmune disease making the epidermal layer of skin to deteriorate and cause severe itching, form plaques, red scaling, papules. It can be due to the genetic predisposition as the affected genes get involved in the control of the immune system. Psoriasis generally doesn't have a specific site, it occurs anywhere on the body including the scalp which results in the formation of plaques that causes excess scales, and its severity may result in loss of scalp hair. Scalp psoriasis tough to treat as the hair acts as a barrier for the application of topical medicines. In this article, we discuss the clinical characteristics, differential diagnosis, effects on quality of life, and the appropriate therapeutic approach for controlling scalp psoriasis. Since, the disease relevance is high and could lead to severe consequence, there is a need for the development of effective therapy.

INTRODUCTION: Psoriasis: It is a kind of non-contagious disease which demonstrates the inveterate inflammatory type of skin condition. It can be seen as sharp delimitated scales, reddish, circular patched skin wounds occurring more often on the articulating sites or stretched skin areas such as on limbs elbows, knees, and scalp, irritating by burning, itching, and mild pain [1]. Other parts of the body are not much prone to have such lesions, but this encompassing form can turn out to be fatal because this uttermost inflammation and skin peeling can disrupt body's tendency for its thermoregulation and barrier functions. Psoriasis on the scalp challenges the quality of life, social stigmatization, and isolation.

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The major limitation of the topical applications is the presence of hair which prevents a proper administration and exposure to light in the most number of cases. Due to the proximity of facial skin, the risk is raised of steroid-related skin atrophy, and the irritation turns out to be horrible. In this, the proliferation of epidermal keratinocytes and failure of maturation of cells into normal keratin occurs. But it is not supported by the evidence that the proliferation of keratinocytes is occurring due to dysfunctioning of the t-lymphocytes.

The triggering factor can be bacterial, viral or possibly self-antigen, observations have indicated that the streptococcal antigens might be the reason generally. The cause of persistence may be due to the cross-reactivity as of the molecular mimicry between bacterial and self-antigens, but no such precipitating factors in the majority of cases reported. Approximately 10% of the population affected with psoriasis tends to develop arthritis that will harm their knee, wrists, feet, ankles and lower

back, deformation of the joints can be seen making it more disabled. Nails on the fingers and toe gains are scaling, and formation of the crust, and therefore nail plates shed and becomes disfigured. Despite having an abundance of available treatments, scalp psoriasis is more difficult to treat than psoriasis in other locations as the surface becomes comparatively more accessible because of the hair and its proximity to the facial skin, which is more susceptible to potential irritants. Patients often fail to adhere to the prescribed treatment due to its organoleptic characteristics, such as the smell or greasy feeling of the preparations.

1. But the Factors that can Aggravate Psoriasis are:

Streptococcal Infections: As it shows up after 2-3 weeks of streptococcal infections.

Mental Stress: There are no such obvious reasons but probably can happen due to the inherited defective skin.

Trauma: Can cause lesions in some patient with psoriasis

Drugs: Chloroquine or lithium compounds may become the cause for the precipitation and aggravate psoriasis.

1.2. Age Incidence: Found very rare below 5 yrs and not generally seen between 5 to 10 yrs. But it is mainly seen in the early 20s and then after 6 to 8 decades of life therefore 15 to 30 yrs are the most susceptible age. The incidence of the first lesion slows progressively after passing of a few years.

2. Difficulties in Treatment: [2, 3, 4] Scalp psoriasis can be more difficult to treat than psoriasis on the body because the hair obstructs the area that needs treatment and can also trap the scale, so it is less likely to rub off. The fast growth and deposition of the scales and turn out to become a thicker plaque. It can be difficult to see psoriasis on the scalp, so it is more challenging to apply the treatment.

2.1. Treatments Generally Used: [2, 3, 4] The therapy of scalp psoriasis pinned for each takes into account a patient's lifestyle, time available and any physical limitations. Being a noncurable disease, its symptoms and other bad effects can be kept controlled with a good treatment regimen.

Prescribed treatments are available in special formulations for use on the scalp such as gels, mousses, shampoos, and lotions. This means they can be more easily applied to the scalp. Potent steroids are the more commonly prescribed treatment for scalp psoriasis, but these should be avoided on the face and around the ears. Their usage can be continued for several weeks at a stretch to bring down the disease, and gradually phase it out by lapsing into the treatment using coal tar shampoos and emollients.

There comes the time when the steroids become ineffective after its chronic use, and an alternative approach has to be sought for a while to reduce the thickened inflamed, scaly patches. More often the treatments will be variably different for specific body sites and for the most helpless sites a combination therapy is done to get an appropriate result as recommended by the prescriber.

Treatments done are as follows: a set of emollients or usually called as moisturizers help to add some moisturizing to the dry skin. The penetration of topical medicines is thus enhanced by the reduced dryness, scaling and softening of cracks. They are used as a substitute for soaps during bathing, washing and also applying before the topical treatments. It has to be left for 30 min after applying a moisturizer before applying any other treatments. For mild psoriasis sometimes emollients are enough to respond. Emollients are containing salicylic acid a very liberal application should be done. Preparation with salicylic acid reduces exuberant scalings but can irritate the surrounding skin. The use of topical steroids is to treat the inflamed skin and can contribute well on the face or in the folds as in the underarm for a short period.

Potent topical steroids are powerful on the palms and soles with the thick plaques. They tend to relapse on cessation of the topical steroids, especially when the potent steroids are in the course but has to be watched closely by the prescriber. Medicated tar bath can be followed to remove scales from the patches. Their formulations include shampoos, ointments, and cream. Their effect is considerable, but most of them find it messy to use as it has a strong smell and it stains your clothes. Dithranol is a well-known treatment for chronic scaly psoriasis and is taken as a home prescription

also, it requires a short contact therapy and if done by staffs who are more trained to apply it.

2.1.1. Application to the Scalp: If you have someone to help apply the treatment to your scalp at home that can be helpful. If not, try to feel where the psoriasis is situated, you may feel a roughness, tightness or crusting if the plaques are raised. Due to the sensitive and thin skin of the face and the skin behind the ears precautions should be taken on the usage of the potent steroids if it flows down to the face or neck and causes more damage. The hands have to be sanitized after the application as the steroids can result in some harmful effects on the other parts of the body like mouth and eyes, being a potent drug trace amounts is more than enough.

2.1.2. Treatment Duration: Treatment duration of eight weeks is the time generally considered as the effective period for checking if the drug is efficacious or not as the control over it is achieved within this period. And on no developments, the physicians have to be consulted again to find a proper effective therapy, and it has to be done within four to five weeks of the onset of the treatment. A daily basis administration and treatment regimen has to be followed when the disease is active. When the clearance is accomplished, it remains important to maintain that sort of improvement that we already achieved, and that can be carried out with the usage of a tar shampoo and a moisturizer, if on the scalp occasionally with an oil or emollient when it is too dry or mild scaly. If the situation remains uncontrolled, it has to be nursed with the proper care to the scalp in any of the treatment centers specialized for this ailment or in some rare situations a systemic therapy can be obtained.

2.1.3. Additional Techniques for the Removal of Thick Scale: As the prescription will involve all the potent treatments with the steroids and tar it proves its effectiveness once the thick adherent scales are removed, and in this point of time these emollients and ointments are used for the moisturizing of the dry scalp or skin and proves out to become a better combination of the treatment and that to facilitates the penetration of the active ingredients deep into the epidermal layer. As of now, there are not many specific products launched for this problem in the market, but oils such as coconut oil, olive oil, arachis oil give a small relief or any emulsifying agents available in the pharmacy, followed by washing with the medicated shampoos or tar shampoo as prescribed by the practitioner. When the scalp is damp a gentle removal of the soft loosened scales can be done manually. Small assistance can make it lot easier to remove such kind of scales from the wet scalp, very fine-toothed plastic combs can be used for this a very gentle rotatory movement will help it to take out and loosen the scale gently and taken out slowly. A very gentle and slow movement is preferred and being more aggressive can damage the skin and cause wounds on the scalp and result in hair fall to increase. Shampooing the hair afterward will help remove the debris from the hair which stuck onto it. The two consecutive washes are needed if the remains are still sticking or if it is too oily and at last a hair dryer have to be used to dry it.

2.1.4. Precautions to be taken: [2, 3, 4] The treatment for the breastfeeding or pregnant women has to done carefully as the drugs might cross the placental barrier and can be teratogenic, so before the administration, it has to be checked for their suitability to a known practitioner. Treatments containing liquid paraffin are a fire hazard and materials that may have become soaked in the treatment should be kept away from naked flames.

2.1.5. Level of Acceptability by Type of Vehicle Used in the Treatment of Scalp Psoriasis: [5]

- **a.** Acceptance by the patient (higher to lower)
- **b.** Shampoo
- **c.** Alcohols based lotions
- **d.** Gels, foams, emulsions, creams, ointments

3. History:

Psoriasis during Old Times: The drug was discovered in Mesopotamia, by Babylons, Sumers, and Assirs. The past information for this ailment used the clay tablets 3000-5000 year ago [6, 7]. That time these skin diseases were, called “asu”, in Mesopotamia and the relief was hailed from seers and priests at that point in time. So many medicaments were used, with magical ceremonies done along for the enchantments. The information was scarce with the Hebrews, with only aim to prevent the disease from coming and was found

mainly in the religious scripts as in the Talmud and Old Testament. A small mentioning of a cutaneous problem in the Leviticus, called as zaraath, of which few believed it to be psoriasis, leprosy, fungal diseases, or a skin condition not known much. The Charaka Samitha stated very much importance to such kind of the disease and was mentioned in the Ayurvedic form of medicines and other Indian medical scripts, shown to have a greater impact on such kind of problems. They mentioned the disease as khusta and detailed on it. Probably at that point, everyone addressed it as leprosy, after which Paul Richter termed its psoriasis.

The father of the western medicines or Greek scientist in the period of the golden age, Hippocrates made a distinction of such diseases to come from the influences of divine and religious processes. These itchy lesions on the genitals and eyelids were named as 'psora', in Greek. He based its treatment from tar and climate. Then other he mentioned as 'lopoi' which in Greek stood for skin conditions in the form of scales with the introduction of leukos and alphos for disorders with maculae but cleared it as psoriasis.

During the 1st century the Empire of Romans described impetigo which appears on the surface of the nails in the books of "Cornelius Celsus De re medica libri octo" and extremities in the different editions by different authors. The mode of treatments was with drugs containing sulphur and pitch [8]. The mentioning of psora was done in the scripts of Naturalis historia by Plinyan another Roman encyclopedist, it was not detailed much as a disease, of which the roots of cucumber were recommended. Physician of Roman emporors, Galen was also among the first who to find disease called psoriasis but described it only for an itching and scaly eruption of the scrotum and eyelids, which was later known as seborrheic dermatitis. The pre-Columbian period saw the Maya, Incas, Nahuas, and Aztecs, were interwoven with magic and religious elements and was treated with plants. A disorder that was, believably psoriasis, that was treated both topically and internally with resins and herbs [9].

Psoriasis during its Mid Age: Writers in accordance with Hebra utilized most of the time in feather brained comments on the writers of ancient classic period and physicians, on the other hand, the disease remained a big mystery and cause still unknown. The majority number of individuals was cured by barbers and quacks. The physicians in the Arab countries possibly distinguished other skin diseases from psoriasis whose existence was already there in the VIII century; moreover a psychotherapy treatment was also done. During the earlier period of the 13th century, many manuscripts translation was done into Latin which later became the most widely used language by the educated people.

Psoriasis in the Renascence: [8, 9, 10] The rebirth of this disease covered roughly between the 14th and 17th century, during the late Middle Ages and then affecting the rest of Europe. During this time some authors mentioned the diseases psora and lepra in their books. Johannes Manardi indicated the disorder "psora" in his Epistolae medicines. The professor at the universities of Padua, and Bologna Hieronymus Mercurialis discussed their importance of skin diseases. The book was entitled 'De morbis cutaneis et omnibus corporis humani excrementis'.

Garrison named it as the "systematic text book on diseases of the skin". Mercurialis distinguished various skin diseases, similar to that of Galen "capite ad pedes" one for the scalp and other for the entire body, subdividing into different color, shape, and bulk and named it as "lepra grecorum". And all the other disorder termed as "psora". B. Ramazzini in the 1700s published his research "De morbis artificum diatriba" in which described, all the skin conditions also pointing out a lot of various causes for this condition those differing from the Hippocrates's theory [12, 13, 14].

18th Century Psoriasis: [14-22] In 1714 Daniel Turner published his book titled as "De morbis cutaneis" a treatment of diseases incident to the skin, which gave not much specific description on psoriasis that he called "leprosy of the Greek", but knew the local application of ointments and systemic drugs to be given internally. In the later stages of 18th-century naturalist from Sweden and physician, Carl Linnaeus set a binomial terminology, and comprehensive classification was done for the plants. In 1735 it was published as Systema Naturae. Francois Boissier discussed the same

problems in Nosologia methodical were diseases classified into ten classes having 2400 species.

In 1777 Charles Anne Lorry a French dermatologist published the book with an etiologic classification on skin diseases and their interaction between internal organs, especially the gastrointestinal, nervous system and skin. For the longest time the surgeon treated skin diseases and therefore J. Plenck, D. Turner and C. Lorry were considered to be protodermatologist, and their efforts introduced the first dermatologist like JL. Alibert and R. Willan, English physicians, published the Book on the cutaneous disease which was made simpler and better on the skin diseases from eight elementary lesions. He used the term psoriasis for the papulosquamous disease, in the order and differentiated psoriasis from leprosy (psora leprosa and lepra grecorum). Various forms of psoriasis were described: diffuse, guttata, palmaria, gyrata, unguium and inveterata. The disease originated from the elbows and knees, affects scalp, toe and finger nails. Later, the French physician Jean Louis Alibert who worked and taught at St. Louis in Paris, dedicated to skin disease. He went against to Willan classification and made an order to systematize the skin condition. He classified diseases in union with other botanists B. De Jussieu and divided the skin conditions into 12 classes or groups.

Ferdinand von Hebra in 1841, divided psoriasis from leprosy by modifying the terminology and classification of R. Willan and differentiated them into 12 groups not only by gross anatomy but Karl Rokitansky also used microscopic criteria, introducing a general pathology to describe skin diseases. Regarding psoriasis treatment, he also tried with pilulaeasiaticae (arsenic). So did his successor Moritz Kaposi.

Psoriasis in 19th Century: [23-26] The dispute for the classification still carried further in the 19th century. With the help of pathohistological classification, both psoriasis and dermatological disorders were learned. Alibert in 1822 noticed the joint deformities with this disease, which Besnier explained as arthritis psoriatica. Charles Bourdillon explained it further while Erasmus Wilson detailed its connection with rheumatic and gout disease. Some authors described signs that helped the diagnosis of this disease. Heinrich Kobner, dermatology professor, explained the Köbner phenomenon in 1872, *i.e.* occurrence of psoriatic wounds at the site of a physical or other injuries. Heinrich Auspitz, detailed the appearance of papillary bleeding after the scraping out of the scales from the wounds caused, D. Turner, R. Willan, and F. Hebra. Auspitz were the few scientists who introduced a few pathohistological terms like acanthoma and parakeratosis typical for psoriasis.

In 1879, Duncan and Bulckley described the "pellicole decolable". Debates carried through out for this psoriatic manifestation coming from the mucous membranes especially. By the late 19th century Hebra Unna described psoriatic micromorphology, and the microabscess (a micro pustule) was described by William Munro which means neutrophils aggregation at the stratum corneum.

Developments in 20th Century: [27-35] In 1926 Woronoff ring was detailed at the periphery to the psoriatic plaque on treatment after antra robin, spongiform pustule also came into the picture in 1927 by Franjo Kogoj later explained by Mladen Rupecin an ultramicroscopic study. The second half of 20th century it demonstrated that psoriatic epidermis has 25 times more mitoses per unit in comparison to that of epidermis from healthy persons. Ekel and Van Scott explained the keratinocytes of patients with psoriasis with a significant shortage in their cell cycle of about 311 h in the normal individual to 36 h and the turnover time is decreased from 27 to 4 days.

Many authors studied genetic alterations were studied and now according to the evidence the disease is multifactorial means happening due to multiple genes. The susceptible genes are mapped on various chromosomes like PSOR1 - PSOR10. It can be triggered due to environmental factors too. The type 1 psoriasis found the association with the HLA, which is inherited and has more severe outcomes and develop at a very earlier stage, on the other hand in type 2 the disease develops later and is less inherited. Past decades have seen various immunological researches compiling evidence on innate and adaptive immune response in the patients. Researchers found overgrowth of activated lymphocytes, CD4 in dermis and CD8 in the

epidermis. It shows a dysregulation in the immune system and anewinsightinits pathogenesis. Psychological stress can also alter the disease state.

4. Etiopathogenesis of Psoriasis: Etiology of psoriasis remains a big mystery for all which always have turned out to be a big complication due to its complexity in the treatment regimen following that of the resemblance to seborrhoeic dermatitis. It is majorly accounted with late or early onset of pustular psoriasis erythroderma, psoriatic arthritis, guttate psoriasis, and psoriasis vulgaris [36].

Concerning Seborrhoeic Dermatitis and Malassezia yeasts: The overgrowth of Malassezia species on the scalp having the same characteristic features as shown in scalp psoriasis and also the same species found in the areas dominating with sebaceous glands as like that in the scalp [26]. Malassezia species indicates that there is a presence of Malassezia yeasts which can be held responsible for the pathogenesis of the disorder at the same time due to pityrosporal colonization [25, 27]. When the disease is at its peak or during aggravation, Malassezia globosa presence was seen at a considerable rate. There comes a small difference in the spreading when the severity of the involvement of scalp is seen with Malassezia species in normal and diseased condition [28, 29].

As a part of Koebner response and colonization, the hypothesis can be stated that psoriasis arises from seborrhoeic dermatitis in relation with Malassezia yeast. Clinically aspects term as the combinational effect of scalp psoriasis and seborrhoeic dermatitis can be addressed as 'seborrhiasis' [6].

HLA and its Association: Studies show that with negative HLA-Cw6 the involvement of the scalp region is predominant in the affected than those who have a having positive HLA-Cw6, all this is changed in Caucasian patients [26].

Exacerbating Factors: The commonly used treatment was done with anti-tumour necrosis factor alpha (TNF-α) for psoriasis, but then the results have authenticated new oncoming or blazing up of psoriasis in the adult population who are dealt with other considerations. The severity of the scalp involvement found in the small children having anti-TNF-*α*-induced in psoriasis [30]. It is possible that exacerbating of scalp psoriasis can also be seen as hypersensitivity caused by cosmetic styling products, shampoo or dyes could [31].

Immunological Factors: Due to the involvement in immunological factors there are more chances of it being related more to the maturation of psoriasis. It was found that long-term absolution of scalp psoriasis requires removal of immunological constituents using surgical process within the dermis of the skin layer [25].

Other Causes: Increase in the assigning of stem cells, which ultimately results in the cells to go to the anagen phase comes as one of the cause. Up-regulation in the catenin pathway results in the cascade of events with a key factor played by monocytes and macrophages.

Grading: From severity and the extent of scalp involvement scalp psoriasis can be divided into mild, moderate or severe and severity happens by erythema, scaling, pruritus, and thickness [26].

TABLE 1: GRADING OF PSORIASIS

Area	Intensity of disease	Skin conditions
Less than 50% of the scalp	Mild	Mild erythroderma, scales, minimum thickness, pruritus
Less than 50% of the scalp	Moderate	Moderate redness and scaling, medium thickness and mild pruritus
More than 50% of the scalp	Severe	Severe redness or erythema and scales, severe pruritus scares and hair loss, more than usual lesions

Hair Loss in Scalp Psoriasis: It won't always result in hair loss or shedding in excess but the increased amount of shedding of telogen phased hairs, and reduced hair thickness as usual. An extensive amount of hair loss is seen in erythrodermic psoriasis and chronic severe hyperkeratinization may cause carrying alopecia [25].

5. Histology of Scalp Psoriasis: There will be few epidermal and follicular related changes like perifollicular inflammation, infundibular dilatation and fibrosis, thinned epithelium and fibrous nerve tract [32]. The main identifying feature of scalp psoriasis is sebaceous glands regression and of lymphocytic penetration and polymorphonuclear leucocytes through the epidermis [25, 33].

Due to extremely complicated cytokine environment, sebaceous gland atrophy is caused. Plaques classified by the prepotency of cytokines by TH1 cells, which includes IL-2, IFN- γ and TNF-*α*. The interactions of chemokines and cytokines cause sebaceous glands to atrophy in an autocrine and paracrine fashion [32].

5.1. In Adults: Scalp being one of the primary site getting affected and remains constant almost for many years, on the other hand, lesions developed will remit subsequently [8]. Many cases are there with the involvement of scalp at initial and later develop to other sites [23]. Typically, these lesions are delimitated and gain a very thick greyish white scale and complain registered for the shedding of scales and pruritus. It can happen during other forms of psoriasis too as it have got many phenotypical variants.

Koebnerization causes asymmetry and with picking, harsh shampooing, scratching, scrubbing, *etc*. There comes a difference in the severity that is from mild scaling to highly inflammatory crusted plaques. Areas neighboring to the scalp such as (upper neck, forehead, ears, *etc*.) gets affected with the direct extension up from the scalp or by itself [23].

5.2. In Children: About 47% to 53% of children are always affected with scalp psoriasis. Hairline and occipital scalp are the first sites of involvement of this disease. In the juvenile period, plaques become erythematous, with silver scales which are finer than in adults and localized to the elbows, knees, scalp and post-auricular region [35]. Most of the times, pityriasis amiantacea occurs first in pediatric psoriasis [25].

6. Scalp Psoriasis and Hair Loss (Psoriatic Alopecia): It might not result in hair loss, but sheds more of its telogen hairs reduced hair volume is common. Scarring alopecia induced due to erythrodermic psoriasis and chronic severe hyperkeratotic scalp psoriasis [25]. It can be a scarring, or non-scarring process few studies indicate it as a scarring process which means lessened hair follicle and peri-infundibular lymphocytic infiltrate causing destruction. Complete regrowth with topical anti-psoriatic treatments is advantageous for a non-scarring process. Psoriatic alopecia relates to the upper inflammation of the perifollicular region or the permanent region, particularly the attachment of arrector pili, the bulge has got the stem cells which arises to multipotent matrix cells. Multipotent cells can give birth to hair shafts, sebaceous gland, and surrounding epidermis. In a midway, the damage happens to the sebaceous gland [32].

6.1. Three Types of Psoriatic Alopecia Include:

6.1.1. Localized: Loss of Hair from the lesional skin as verified by hair pluck revealing dystrophic bulbs.

Histopathology: Same as that of non-scarring alopecia with specificity for the sebaceous gland atrophy.

6.1.2. Acute Diffuse Hair Fall: Less amount of hair falls in dominance with telogen hair follicles.

Histopathology: Increase in telogen hair due to perifollicular infiltrate.

6.1.3. Destructive Alopecia (Scarring Type): It is associated with reduced hair volume and destruction folliculitis with perifollicular inflammation and fiber tissue replacement.

Histopathology: Same as that of scarring alopecia.

7. Dermatoscopic Findings in Scalp Psoriasis: G W. Kim explained the evaluation of vascular patterns by dermoscopy which is important for the diagnosis and creation of a distinction between scalp psoriasis and seborrhoeic dermatitis. Most significant dermoscopic features involve red patches and globular mass, spiral red spring loops, and glomerular vesicles. But in case of Seborrhoeic dermatitis that is seen by branching of vessels and strange red vessels with no presence of red dots and globular masses [36]. Regions free of particular vesicular patterns were observed frequently in seborrhoeic dermatitis [37]. Melike Kibar studies discovered Signet Ring Vessels, wired red vessels, dots and globules, structure reduced red regions and hairs hidden considerably more usual in psoriasis on the other hand comma vessels and twisted red loops in seborrheic dermatitis [38].

7.1. Atomic Force Microscopy (AFM): Patients having scalp psoriasis their hair shafts show macro pits when seen with Atomic Force Microscopy with the generalized nature of psoriasis, changes in hair corresponding to the changes in skin and nails [39].

7.2. Diagnosis: Dry, flaky scalp with well-distinguished plaques are the primary diagnosis done clinically. Patient's family history confirms the presence of the suspected disease, on the other regions of the body will support the evidence uncertainty is solved by the skin biopsy and their no as such blood tests for this disorder [31].

8. Quality of Life in Patients with Scalp Psoriasis: Scalp psoriasis patients have a problem to get a good social life due to the exposed conditions of the scalp and psoriatic lesions, and their social life gets stigmatized in total lowering their quality of life, [1, 40] a very chronic treatment is a must [41]. At the early or adolescence, the quality of life gets compromised with a lack of social mingling if the patients suffer from alopecia [5, 35]. They become more sensitive to depression and low mood, and it is important to encourage them for their wellbeing [31].

8.1. QoL Assessment Instrument for Scalp Psoriasis:

Scalpdex: An instrument specifically designed for issues related to the quality of life by scalp dermatoses measures longitudinally to find the impact of scalp psoriasis. It becomes a very important tool to evaluate and monitor its impact in a much-sustained fashion with that of the treatment regimen [34, 42]. The Children's Scalpdex in Psoriasis (CSP) gives a very reliable response validated for checking of QoL of children having scalp psoriasis. It might require a targeted questionnaire for evaluating the outcome and their therapeutic interventions [42].

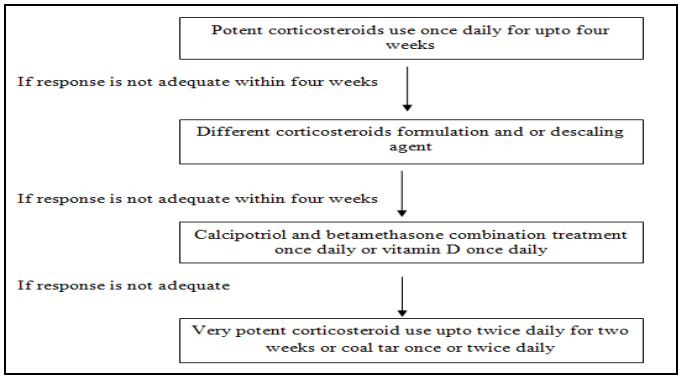

FIG. 1: TREATMENT ALGORITHM OF PSORIASIS

Scalp Psoriasis Severity Index: Psoriasis Area and Severity Index (PASI) tool to check the severity of the disease and the affected regions but this measure calculated by measuring the body surface area percentage hence there are chances to underestimate the severity of scalp psoriasis if few lesions are there on the other side. Hence, it had to be modified especially for scalp psoriasis later named as Psoriasis Scalp Severity Index (PSSI). But there is no frequent use of this study in the clinical field still it can contribute well in clinical trials [26].

9. Algorithm for Scalp Psoriasis Treatment: There is treatment algorithm that has been put up for the treatment of scalp psoriasis into mild, moderate, or severe scalp psoriasis. Thus, it becomes easier for treating a given patient by cross-referencing the severity with that of the phase of the drug to be used. Patients, where the severity is a mild topical treatment, is done with vitamin D_3 analogs and corticosteroids is sometimes recommended because there are not much of the potent drugs as that in class four classification.

Most of the times a short contact formulation, like shampoo should be used or the medications have vehicles in the form of a lotion, solution and gels will be more suitable. A sporadic or a regular therapy using short contact formulation of corticosteroids can be suitable enough. When the condition is moderated scaling can be done using salicylic acid as the major ingredient for scalp psoriasis. Short contact formulation having corticosteroid and vitamin D becomes the most appropriate. Vectors can be in the form of lotions or gel, even few occlusive treatments involving creams and ointment, shall be taken for use, so as the phototherapy, if needed.

When the condition turns out to be severe then the salicylic acid is preferred for descaling, and then potent corticosteroids to be the first topical treatment used. Short contact formulations can be used to an individual's convenience, but long contact formulations become mandatory in a few patients, along with the radio and phototherapy.

Systemic treatment using cyclosporinmethotrexate, retinoids and the new biologic agents, can be productive in patients with widespread involving the scalp. No algorithm fully reflects the complexity of the clinical situation rather it has to be treated with good adherence. To have an effective treatment, the severity will signify qualitative decision, not only the affected surface

area has to be seen but have to search for other signs and symptoms, keeping an account the quality of life, treatment response and its localization. A treatments effect shall not compromise the quality of life as it can be time-consuming, embarrassing, adverse reactions may occur, and all of it can reduce patient compliance.

There can be multiple treatment options, but appropriate to prescription becomes most convenient for the patient, so the formulations should be selected after detailed research. This algorithm never accounts for variations happening in therapy or preference in different places or regions according to its geographic locations as there comes significant regional variations even in the same country itself like the tar formulations are used in the UK but not used in Italy or France, but both of then lie in the same continent. It takes into account the vital need of descaling but will not account for any other add-on treatments. They don't account for the drugs lying out of the algorithm like antifungal agents such as ketoconazole. But still they are required in immune-compromised patients, infections due to Malassezia yeast as evidence that they can become beneficial to the scalp [43, 44, 45].

TABLE 2: AVAILABLE TREATMENT FOR PSORIASIS AND THEIR EFFECTS

Treatment did topically	Effect
Topically used steroids	Helps for these small local lesions and needs monitoring
Vitamin D	Acceptable as a cosmetic. Not to be taken during pregnancy and breastfeeding. The combination with corticosteroid ointments in short-term use
Keratolytics	Takes out excessive scaling and might irritate the surrounding skin
Dithranol	Acts well in chronic scaly psoriasis in specific areas
Vitamin A	Once a day. Shall not be applied on face, or large parts on the body or at any folding in the body. Contraindication for pregnant and breastfeeding women
Tar formulations	Takes out excessive scaling and stains the dress
Emollients	Reduces the itchiness and dryness, scaling is reduced, softening of cracks and penetrates the topical regions

The presence of phototherapy can be included using psoralen + ultraviolet A, ultraviolet B but this option not likely to be available in few primary cares. But in some cases, this remains inevitable due to the need to have the phototherapy. Same way few studies state the availability of the use of systemic biological therapies in treating scalp psoriasis, and these agents may not be economically feasible at times, and fast outcomes or results or predictions appears promising [46, 47, 48]. Mostly topical and systemic therapies are the most preferred ones.

9.1. Treatment Principles and Guidelines: The treatment rationale of this approach facilitates treatment procedures which count both subjective and objective severeness. Physicians consider the QoL of patients by the early response to the treatment, formulation selection, and adherence of the medicines by its cost, duration of treatment, self-management and adverse events [49].

9.2. Older Treatments: Old time techniques involved phototherapy, shaving, Grenz rays, and pulsating magnetic fields. Earlier times the topical preparations used a mixture of phenol, liquid petroleum and sodium chloride [50].

9.3. Current Treatments: First-line therapies for all patients include the topical preparations and the choice of treatment done by patient preference, the severity of the disease, previous response, and cost, efficacy, tolerability and compliance [5].

Vehicle: The vehicles are the carrier or vectors into which the drug is loaded can be a shampoo or scalp application like a gel, alcohol lotion, emulsion, ointment, creams, and oil.

9.3.1. First Line Therapy: Topical corticosteroids, Vitamin D 3 analogs, salicylic acid / urea, calcipotriol, dithranol / anthralin, coal tar, tazarotene, combination therapies.

9.3.2. Second-Line Therapy: Phototherapy, systemic treatment acitretin, methotrexate, cyclosporine, and biologics.

9.3.3. Leave on Products: These include gels, lotions, and ointments containing steroids, coal tar, salicylic acid or vitamin D analogs.

9.3.4. Wash off Products: Sulfur, shampoos with coal tar, selenium, salicylic acid, and ketoconazole or zinc pyrithione.

10. Details on Few Topical Corticosteroids: These drugs act as anti-inflammatory, anti-proliferative which help in reducing pruritus, scaling and erythema [50]. It shows rapid action, comparatively less adverse effects, and patient compliance is more [35]. Formulations include Short contact foams and gels shampoos, lotions perfect for mild or moderate disease ointments and creams for moderate to severe disease. Side effects are potent drugs cause atrophy of the skin, telangiectasia on long-term use, but these are used very less on the scalp, as the skin is thick and absorption steroid limited due to hair and sebum. Traditional, treatment for scalp psoriasis used to be topical coal tar therapy in combination with anthralin, due to the unpleasant smell and staining property this approach has its limitation, and the adherence remains a big question for those patients using it. The most important factors governing its adherence is the type of formulation or the vehicles used for it. Indeed, vehicle formulations of topical treatments are an important factor in patient adherence. Many of the ancillary treatments include shampoos and gels constituting coal tar in solution, anthralin in an emulsifying agent in an oil base, 5% of glycolic and lactic acid scalp lotion plus betamethasone scalp application.

Phototherapy with UVB and topical products involving calcipotriol is effective in combinations. Hair which becomes a barrier for effective treatment with UV phototherapy, sometimes it might need broadband UVB comb for its delivery on to the scalp. Extensive plaque or recalcitrant psoriasis, systemic treatments are preferred with cyclosporine, methotrexate and acitretin, and infliximab, etanercept, and alefacept in biologics classification. This is not preferred for the treatment of isolated scalp psoriasis but, for treating the plaque psoriasis on other parts of the body, it provides an added benefit by taking care of the scalp.

10.1. Topical Formulations of Vitamin D Analogs: Analogues of vitamin D3 functioning is by inhibiting the proliferation of epidermis and normalizes the keratinization and at last reduces the inflammation [25]. Vitamin D_3 products, mainly calcipotriol, are available in the form of lotions, gels, and even shampoos. Lotions are supposed to be patient friendly and substitute the other corticosteroids, and tolerance level is also high, available in oil-based formulations [51]. Due to its minimum absorption in the systemic area side effects are also very less in number and when used for a longer period irritation occurs during early dosing in the regimen. Few side effects involved are extremely drying burning sensation.

Calcipotriol is a drug of choice in vitamin D3 analog only because of its least adverse effects than that of calcitriol based on the metabolism of systemic calcium ions, with a good safety profile [26, 51, 49]. 0.005% of the solution is taken and administered on to the area where lesions are there and gently massaged on the scalp two times in a day; it takes up almost eight weeks [49]. Vitamin D_3 derivatives and topical steroids have side effects in the least amount, lessen the inflammation and proliferation, better QoL, and at low doses give a well-maintained therapy. Calcipotriol and betamethasone dipropionate combined gel can be tolerated easily and proved to be an effective treatment at an adolescent stage [26, 52, 53].

10.2. Keratolytics: Scaling of moderate to severe cases keratolytics such as salicylic acid proves very beneficial, before initiating any other topical therapy it may prove ineffective until thick scales removed, in turn reducing the drug penetration [1]. Salicylic acid, 5 and 10%, mostly used keratolytic which is formulated mostly in a solution gel, petroleum jelly [51].

10.3. Anthralin: It used for the chronic treatment at 0.1-3% cream has been used for scalp psoriasis widely. They are mainly applied once daily to the affected area, rubbed on the scalp for 5-10 min prior to washing with shampoo and rinsing. Creams are made with comparatively higher concentration and gradually increased according to the response and patient tolerance. Not used for any acute minor inflammation. Redness, irritation, fingernails staining, hair turning grey is the few side effects [49, 54]. Caution advised for patients with the history of allergy to preservatives, *e.g.,* parabens. Anthralin also acts as a substitute for the patients who are not responding well to the other topical treatments. Dithranol 1% applied on the plaques for 2 h and then wiped with a cloth. Night time, steroids, especially with the salicylic acid combination, may prove effective.

10.4. Coal Tar Preparations: Crude coal tar acts as the most effective treatment against pruritus. Its application is tough on the scalp; hence 2 to 10% shampoos of coal tar are the most effective ones. Tar formulations like liquor picis carbon are (LPC) or liquor carbon is detergents (LCD) is generally used for these problems. They have to be used twice weekly for good results. Unpleasant smell, staining and messed up formulation type and mutagenic potential are the few problems that are found in such cases [26, 25, 41, 52]. Coconut oil compound ointments are the newer formulations (coal tar solution with precipitated sulfur, salicylic acid, coconut oil, soft yellow paraffin, and emulsifying wax) and tar pomades (LCD, tween 20 and salicylic acid in a hydrophilic ointment). They are applied at night and washed off in the morning with a shampoo [49].

10.5. Dithranol: Dithranol was earlier used in the old times for the treatment of psoriasis but has been reserved for more and severe cases of psoriasis and also in the resistant type of conditions. Demerits involve staining, burning and its inability to be washed out completely [26, 49].

10.6. Antifungal Agents: Considering the etiological role in the overgrowth of *Malassezia species* the treatment with the antifungal agents are good, but in the case of psoriasis treatment, they are inconsistent (plays a role in the development of both scalp psoriasis and seborrheic dermatitis). Ketoconazole in such condition might be effective due to both the anti-inflammatory and antifungal property and becomes useful in mild psoriasis. They are most suitable for sebopsoriasis patients or immunocompromised patients. Topical imidazole derivatives are useful in the cases with resistance and control the proliferation of pityrosporum [49]. On the combination of bifonazole, 1% and urea 40% proves out to be a very effective treatment for scalp psoriasis along with that of seborrhoeic dermatitis [25].

10.7. Tazarotene: There are no such controlled studies going for this drug, but still it can come in the selection for this disorder (0.1%) use in scalp psoriasis their response is minimal on comparison done with calcipotriol or steroids, even though this performance is not that good but still the relapse rate for such medicines are less. Side effects include extreme dryness and irritation [49].

10.8. Moisturizers: They are not the first drug of choice for treatment as it gives supportive care and effectiveness to the scalp. It reduces the rate of itching and discomfort of dryness, scales get softer and enhance the penetration. It thus increases the effectiveness of topical treatments having active medicament in it. As the scalp is the hairiest area in the body, emollients have to be made thinner and not greasy at all and should not flow down. Lotions and oils are said to be the best formulations in these conditions and are asked to be applied while going to bed, and washed away in the morning to minimize any undesired effect. Mainly includes coconut, olive or arachis oil [31]. Urea 10% and lactic acid 10% helps in the moisture using effect [49].

10.9. Cosmetic along with General Care: [31] A very regular routine of hair wash is mandatory for the removal of debris is needed. Demonstration of the application has to be done, with the partitioning of the sections of the hair and then applying it on the scalp with emollients and non-shampoo topical treatments in a sequential fashion. The through information on the hair care products available in the market has to be done by the doctors and nurses with their negative effect on the scalp or any interaction with other psoriasis medications.

11. Various Laser and Systemic Treatments:

11.1. Light and Laser Therapy: The hair present on the scalp makes the delivery of UV rays a big problem as it always gets hindered. Phototherapy in such cases is very less effective unless it's shaven properly, not a much-practiced method but patients have to go to those centers or clinics. But it is preferred for cases severe or when the treatment remains resistant. Good results are seen when the conventional UV method is given and also the hair is parted into various sections as rows, and the head is shaved properly. UVB comb is very advantageous for its delivery at various sites inside the thick hair and reaches scalp effectively.

Excimer laser therapy is very much effective than the other bands of UVB or pulsed laser therapy. Hair blower generally helps in parting the hairs across and makes some space. Also many times it's in combination with topical psoralen and UVA irradiation (PUVA) to achieve speedy healing and recovery.

11.2. The excimer laser comes in a narrow band ultraviolet B (UVB) phototherapy which delivers radiation of 308 nm, and due to its high output, it helps in the treatment of individual areas effectively in a short time span. With this kind of treatment and some mechanical support, it appears effective in the treatment of scalp psoriasis. When it is used in supra erythemogenic mode and the plaques are exposed several multiples time of the minimal erythema dose rapid clearance is achieved with prolonged remissions. The main problem here is the multiple time treatment has to be done with a good maintenance in order to maintain the results with a good patient compliance [31, 38, 36].

11.3. Grenz Rays: Grenz ray therapy, utilizes the electromagnetic radiation those are similar to X-rays, but with very less penetration. It is majorly used for the effective and convenient treatment for scalp psoriasis in an alternative way when topical agents have failed [25].

11.4. Biologics: Biological agents with the power of blocking tumor necrosis factors such as etanercept, infliximab, and adalimumab have been in clinical experience for an established period, but, its application in scalp psoriasis is a bit low in level [38]. Reserved for those who either are not able to use other conventional topical and systemic treatments. Few biologic agents approved by US FDA include alefacept, efalizumab, etanercept, infliximab, and adalimumab, while ustekinumab is still being recommended for approval [35, 31, 34, 40, 41, 42].

11.4.1. Adalimumab: It is a very beneficial treatment when the systemic therapy is failing as patients affected with scalp involvement may be candidates for systemic treatment even if they are having mild disease [43].

11.4.2. Alefacept: Alefacepta type of recombinant, a human fusion protein consisting of leukocyte-function with antigen type 3 and immunoglobulin G proteins. It specifically reduces the T lymphocytes memory, mediators for the pathogenesis of psoriasis, it inhibits the proliferation and induces apoptosis in short an effective subset of patients affected with scalp psoriasis, is tolerated well and becomes a good treatment for patients with widely spread scalp psoriasis. It is a kind of dimeric fusion protein. Alefacept given at 15 mg IM once a week for 3 months helps to achieve clinical improvement in patients with extensive and recalcitrant palmoplantar psoriasis [35, 40, 41].

11.4.3. Etanercept: Etanercept is considered to be very effective and tolerated, and it shows significant statistical difference in the PSSI between the experimental and control groups in one study. It was found to be efficacious and well tolerated in Palmo Plantar Psoriasis too within 24 weeks in a randomized, placebo-controlled study. They received subcutaneous injections of etanercept 50 mg or placebo twice a week for 3 months [31, 45].

11.4.4. Ixekizumab (IXE): A type of monoclonal antibody to IL-17A, acts as a cytokine in the pathogenesis of psoriasis. 60% of IXE treated achieved complete resolution of their scalp psoriasis by the 12 weeks, more than those treated with either ETN or PBO [46].

11.4.5. Ustekinumab: It is a human monoclonal antibody which binds to the p40 subunit common in both interleukins 12 and 23, gives a faster and durable action against severe plaque psoriasis with improved quality of life. For the time being, treated with ustekinumab is a second-line for patients suffering from severe refractory scalp psoriasis [38].

11.4.6. Methotrexate: Methotrexate with an optimal therapeutic effect reaching 2-3 months is somewhat effective for scalp psoriasis, there is not much evidence or study that is done on the scalp psoriasis. It implies an adequate number of trials is done with topical therapy and phototherapy. The satisfactory response is achieved within 3-6 weeks after the administration. Dosing is done as 0.2-0.4 mg/kg PO/IM/week as a single weekly dose [33, 36, 46].

11.4.7. Retinoids: Acitretin used mostly on lesions happened on the scalp of psoriasis. It shows its effect on just 24 weeks, but unfortunately, loss of hair happens more in number. Due to the modulation on the epidermal skin of the proliferation and differentiation, it causes some immunomodulatory stress with anti-inflammatory actions. A single dose is for 10-50 mg/day. Less effective than other treatments but effects are majorly based on the dose. The response that we get of this medicine is very slow, 3 to 6 months it will take the minimum to achieve its full potency. The tolerance of acitretin at elevated concentration is less [46, 47, 48, 49].

11.4.8. Apremilast: Cyclic adenosine monophosphate has a major role in immune responses, which are again regulated through phosphodiesterase [50]. Apremilast, being a phosphodiesterase 4 inhibitors, causes an increased level of cyclic adenosine monophosphate, which modulates anti-inflammation and proinflammation. US FDA and by European Commission approved apremilast for psoriatic arthritis later in 2001, and 2014.30 mg of Apremilast BID shows a considerable improvement [50-58].

11.4.9. Cyclosporine: Generally only given for adults who are non-immunocompromised patients with recalcitrant palmoplantar psoriasis. 2.5-5.0 mg/kg/day two doses per day, if hypertension or renal impairment that is there then dose gets decreased to 0.5-1.0 mg/kg. US FDA has an approval for1 year of regular treatment [59-64].

12. Treatment Abidance: The condition of psoriasis worsens when the medication adherence is not there at all, the lengthy period of the treatment procedure will cause the irregularity in the administration and the side effects that come along with the drugs, drug potency and its safety with the type of vehicle. Instead of blaming for the lack of results and immediate cure the patient counseling is very much required which can be done by physicians or the nurses, it covers up all the important factors like applying quantity and treatment period. Mostly seen when the vehicle for the treatment is a foam type of formulation and patients don't have any knowledge about it [65-75].

13. Non-Steroidal Topical Preparations:

13.1. Topical Steroids: Normally, potent to super-potent steroids are the choices for such kind of psoriasis which is used up to 6-8 weeks and some more longer. Few latest formulations involve the foams as the vehicle like BMV 0.12% foam and CP 0.05% foam. They offer a very advantageous cosmetic property over traditional forms, like the very minimum amount of residue after being applied, makes the drying faster and easier, very easy application and no fragrance is involved in preventing any irritation. This, in turn, helps to increase the patient compliance and its efficacy [76, 77].

13.2. Corticosteroids: As the first line therapy uses corticosteroids, topical application is the most recommended formulation. It has to be dealt with various other side effects such as-as striae, atrophy, tachyphylaxis, and telangiectasias, which becomes one of the various limitations of it. Such side effects are included or mentioned because virtually they are never seen in the scalp. Their safety is assured only for 4 weeks as potent steroids establish itself into a harmful irritant.

The preparation of formulations such as gel, creams, ointments, shampoos, lotions, and foams are done according to patient compliance. For clinical clearing very low strength medications should be used in an individual patient for a shorter period, keeping in mind about the possible side effects and resistance. The physicians generally practice longer use of medium potency formulations or its intermittent use.

Clobetasol propionate (CP) 0.05% and betamethasone dipropionate 0.05% is the drug of choice for such kind of diseases. Intralesional corticosteroids patches can also be used if there is no response from topical steroids, [78] there are foam as a vehicle acts really better to other traditional topical preparations as there is an advantage of easy application and least residue amount, their absorption becomes more easy, gets good bioavailability with suppressed hypothalamic pituitary adrenal (HPA) axis and their once per day administration is as useful and effective as twice a day application of other formulations. So, considering in all aspects, it results in better patient compliance.

CP foam 0.05% is enough to perform superior action against scales on the scalp. Dose range is 50 g/week. Medium pot net corticosteroid beta-methasone valerate (BMV) is now available as a less residue foaming vehicle, BMV 0.12%. It showed good progress in the early signs of scalp psoriasis than in BMV lotions or any other standard topical treatment available at that time [79, 80, 81, 82].

Shampoos were the next to be studied in this development process, where clobetasol shampoo 0.05% was tried, and approximately 50% of the patients had good feedback in their daily routine, and 90% of patients voted it to be better before their other treatments for scalp psoriasis.

13.3. Topical Corticosteroids in Combination Regimens: Topical corticosteroids are mostly

combined with agents like topical vitamin D analogs, or in cases of extensive conditions, alongside phototherapy and systemic treatments. This type of combination involving corticosteroids and vitamin D analogs are every potent with least side effects other than the treatment with the active agent alone. A treatment done in a sequence like initially with topical corticosteroid and then with vitamin D analogs for a long-term is showing rapid improvement and is found to be safe. A high potent corticosteroid and vitamin D analogs when used in combination helps in the adherence of the medication, although it won't be as effective as super potent corticosteroids [46, 82, 83].

13.3.1. Calcipotriol derivatives of vitamin D_3 in treatment of moderate and severe scalp psoriasis. 0.005% of the formulation is enough twice a day and is gently massaged on the required area. It takes 8 weeks of time to show some response, not to be prescribed in the patients with acute lesion eruptions, hypercalcemia and hypervitaminosis. The burning sensation is felt on applying with an itching. Irritation ceases as the time passes. Eight weeks will result in clearance of 60% of patients [55, 84, 85, 86].

Mechanism of Action: It binds to the receptors of vitamin D and along with heterodimer with the retinoids X receptor, in turn, brings the proliferation and differentiation down to a normal condition. It causes the reduction of T suppressor cells and CD45 RO+, regulates the Th1 to Th2 [87, 88, 89, 90]. When it is present in the cytoplasm of the cell, steroids are bound to receptors of glucocorticoid, which later relocates to the nucleus where regulation of the inflammation is being happened. Reductions happen in the manufacturing of cytokines, such as interleukin1 and interlukin8, tumor necrosis factors such as alpha and gamma interferon, prostaglandins, nitric oxide and reduced levels of leukotrienes are [91, 92, 93] regulation in the differentiation of keratinocyte also happens at the same time. When the level of T regulatory cells goes down in the psoriatic skin it regulates that too [94, 95].

13.3.2. Coal Tar: Topically applied solutions of tar liquor carbon is detergents LCD are available mostly everywhere for the treatment of scalp psoriasis. Coal tar took in the solution form and sulfur being precipitated with the addition of salicylic acid and coconut oil taken as a vehicle or a base into soft yellow paraffins acting as a emulsifying agent. This type of ointment is applied over night and washed off with any shampoo having coal tar shampoo with 1-20% extract of coal tar in it [96, 97, 98, 99]. 1% Polytar, juniper tar and pine tar. Corticosteroids used in the shampoo are more efficacious than the coal tar and is accepted more as a cosmetic [99, 100].

13.3.3. Tazarotene: Not much used in the treatment of scalp psoriasis but tazarotene (0.1%) is less effective in comparison to topical steroids but the relapse rate is also very less. Common side effects reported are extremely drying and irritation [25, 101].

13.3.4. Combination Therapies: Combinational therapy helps in enhancing the efficacy and toxicity and minimizes the risk of the individual drugs. Corticosteroids on combining with vitamin D analogs reduces certain irritation caused and required drug is very less. Treating moderate to severe cases of the scalp, 0.05% of betamethasone and 0.005% calcipotriene applied once in a day. Study carried out for 8 weeks showed, 71.2% patients achieved results with the combination compared to that of betamethasone dipropionate, and calcipotriene [51, 103, 104, 105, 106]. Steroids and PUVASOL gave better results than only with PUVASOL [107]. Salicylic acid as a cream base with PUVASOL applied for 56 days gave better results than PUVASOL stand alone [108]. Tazarotene combination with topical steroids was very much effective and also with calcipotriol [48].

14. Treatments Coming in Second Line: Only to be taken when all the other topical formulations are ineffective. It includes photo and radiotherapy with the treatments in a systemic manner using retinoids, biologics, methotrexate, and cyclosporine. It is calculated using risk and benefits ratio.

14.1. Biologics Medications: Efalizumab's 12 weeks study at a dose of 1 mg/kg per week SC gave good progress. But it has been withdrawn from European market of its side effects [31].

14.2. Miscellaneous Agents: As the topical preparations do not work till the hard scales gets reduced, and the penetration happens very less so Salicylic acid is combined with keratolytic. Urea

and lactic acid help in moisturizing of the scalp. When resistance happens, overgrowth is prevented by topical imidazole derivatives of pityrosporum in scalp psoriasis [109]. It can be present in the form of hyperkeratotic plaques or pustules. Many a times it happens of overlap between different morphological types [110, 111]. Managing becomes really tough and can lead to various disabilities in the form of non-functioning processes and chronic discomforts. Reducing the irritation has to be achieved primarily with the improvement in the moisturization of the dry arid skin and less are the later targets for complete clearance [112, 113].

14.3. Salicylic Acid: A much known keratolytic agent commonly used with other topical agents. Formulations involve creams and ointments preparations at different concentrations. It is mostly taken with topical corticosteroids. It is contra-indicated to be taken with calcipotriene because it deviates the mechanism of action and also prevents the penetration of ultraviolet B rays [114].

14.4. Coal Tar: Due to its low cost and easy availability it is also a drug of choice. There are formulations which have 1-5% coal tar used like in petroleum containing ointments, where absorbents like starch and zinc oxide can be used. 5-10% of salicylic acid has the keratolytic property. It fights bacterial, fungal and inflammatory conditions [99, 115, 116, 117] because it messes up while applying and its bad organoleptic properties it is less preferred. It sticks on the application and also stains the clothes. Attempts have been made to improve drug delivery through liposomes are also taken as a vehicle to improve its delivery to the skin layer. Lengthy treatment might increase its efficacy [116, 117].

14.5. Combination Therapies: Combination becomes tough as the efficacy has to be achieved with less toxicity of every agent involved in it. Like in the combination of retinoids and PUVA, acitretin dosed at 0.2-0.5 mg/kg for a week later treated with PUVA thrice a week. Once the clearance is achieved acitretin is withdrawn, continued with phototherapy alongside PUVA [118].

14.6. Occlusive Agents: Tapes and other patches which is impregnated with steroids are also used in the treatment rends but not famous in scalps. A new technique of a hydrocolloid gel with an impermeable backing of water and gas is tried that has good adherence to the skin layer. It will have a polymer which is water soluble then will have a retaining agent to retain the moisture and an adhesive substance. Few of the irritations involve koebnerization, excess amount of sweating and a poor in visual appeal. Occlusion done using a hydrogel patch for 8 weeks is considered to be very effective and safe taking alongside the topical corticosteroids [50, 119, 120].

14.7. Other Reported Therapies: These therapies involve the use of topical calcineurin inhibitor, tacrolimus which is also used for palmoplantar pustular psoriasis, and systemic therapy including itraconazole 100 mg/day for 2 months, with some benefits [120, 121].

CONCLUSION: There is a whole population of 70% of people who have their scalps involved while having psoriasis on the other regions of the body. The approach has to be patient-centered one as the proportions being affected surrounds a small area of their total body, other than that it affects their social well being regarding isolation and Quality of Life. Permeating the use of scalpdex instrument is a must. The therapy for this disease has to be individualized with objective severity.

Mainstay factors remain effectiveness, speedy response, preferences, adherent medication, economically feasible, self-management time and various allergies that can come up on choosing any topical therapy. Severe conditions require the oral systemic treatment for resistant scalp psoriasis. Patient education about the use of medications, expectations of efficacy and tolerability issues and long-term management options will help achieve adherence and therapeutic success. Based on the available evidence, potent or very potent topical corticosteroids are the most appropriate initial treatment for an individual presenting with scalp psoriasis in primary care.

In patients with thick scale, it is appropriate to use a keratolytic agent alongside the corticosteroid. A treatment algorithm for the management of scalp psoriasis is the primary care and based on the available evidence, potent or very potent topical corticosteroids are the most appropriate initial treatment for an individual presenting with scalp

psoriasis in primary care. In patients with thick scale, it is appropriate to use a keratolytic agent alongside the corticosteroid. Scalp involvement in psoriasis is frequent and, due to the visibility of the lesions and pruritus, it has a considerable effect on the quality of life of these patients.

Many topical treatments have been used in recent years for this type of psoriasis, with few adequately controlled studies to support the efficacy of any of them. Patient dissatisfaction with these treatments is high, making the use of less greasy vehicles that are easy to apply and safe over the long term important. We currently have stable vehicles, such as foams, that leave a little greasy residue and allow maximum penetration and deposition of the active ingredient with minimal surface residue. In general, gels and foams are preferred to creams or ointments. Other preparations, such as dithranol and coal tar are less acceptable to patients as they stain clothing or have an unpleasant smell. Corticosteroids continue to be the favorite treatment for scalp psoriasis, together with vitamin D analogs. The best therapeutic option for proper control of the disease has been shown to be a combination of corticosteroids, with a fast onset of action, at the beginning of treatment, and vitamin D analogs, with their proven safety, over the long term.

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