


# Optimal Management of Plaque Psoriasis in Adolescents: Current Perspectives

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**Abstract:** The skin is at the interface between the body and its environment and is therefore at the center of adolescent concerns during this period of identity formation and increased awareness of body image issues, and stigmatization. Managing an adolescent with psoriasis involves managing the illness and the individual during their transition from being an older child to a young adult. In addition to ensuring that the patient adheres to treatments and is engaged with the therapeutic strategy, dermatologists may also need to manage issues linked to unspoken suffering or conflicts between the adolescent and their parents, who are often present during consultations. The impact of psoriasis on the social interactions, school life and sexuality of the patients, together with the influence of the internet and social networks, also have to be taken into account. In this review, we summarize the epidemiologic, clinical, and therapeutic data available on psoriasis in adolescents, and propose specific management strategies, adapted to the 21st century, for patients in this age group.

**Keywords:** psoriasis, adolescent, treatment, biotherapies, acitretin, methotrexate, proactive treatment

## Introduction

Adolescence is a period of identity formation and increased awareness of physical appearance. At the interface between the human body and its environment, the skin is at the center of justified or unjustified body image concerns, and real or perceived stigmatization during this period. The management of adolescents can be demanding for physicians, as these issues may be compounded by a lack of interest or engagement from the patients.

Managing an adolescent with psoriasis involves managing the illness, as well as managing the individual as they transition from being an older child to a young adult. Dermatologists need to ensure adherence to treatments and the therapeutic strategy, and may also need to manage issues linked to unspoken suffering or conflict between the adolescent and their parents, who are often present during the consultation. Indeed, it may be important to reserve time to consult with the adolescent alone. Verbal communication is sometimes difficult: every dermatologist has been confronted with the “monosyllabic, closed-off adolescent” who provides responses limited to “yes”, “no”, “maybe”. Understanding the suffering and hopes of these patients is a major challenge for dermatologists. The impact of the disease on social interactions, sexuality, and school work, as well as the role of the internet and social networks, have to be taken into account in patients of this age.

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New perspectives in the field of psoriasis are often associated with therapeutic developments. In this review, we provide a summary of the epidemiologic, clinical, and therapeutic data available on psoriasis in adolescence. More importantly, we propose specific management strategies adapted for adolescent patients, and also discuss the management of adolescents in the 21st century environment.

## Epidemiology

### Prevalence

Psoriasis is frequent in adolescence. In Europe, the prevalence of psoriasis in adolescents ranges from 1.2% to 2.0%, with a roughly linear increase during adolescence.<sup>1,2</sup> Prevalence is lower in the United States, Asia, and Africa, ranging from 0.02% to 0.1%.<sup>3–7</sup> A Californian study showed that incidence doubled between 1970 and 1999, with rates of 29.6 per 100,000 in 1970–1974 increasing to 62.7 per 100,000 in 1995–1999.<sup>5</sup>

### Gender and Prevalence

Most studies show that the prevalence of psoriasis in adolescents is higher in girls than in boys.<sup>7–11</sup> As the sex ratio among adults with psoriasis is balanced, this suggests that psoriasis starts earlier in girls. Behavior, genetic background, or earlier puberty could all explain this difference. There are also slight differences in the clinical aspects of psoriasis according to sex: girls may have a higher prevalence of scalp involvement, whereas boys appear to have a higher prevalence of nail involvement.<sup>11–13</sup>

## Comorbidities

### Obesity

Being overweight or obese, or having central obesity, has been associated with psoriasis in adolescents. The same trend has been observed in adults.<sup>2,7,14–18</sup> and is independent of the clinical type of psoriasis. A family history of being overweight or obese is the major risk factor for obesity in children with psoriasis.<sup>14</sup> Management of obesity in adolescents with psoriasis is important, both for their general health and for the management of their skin disease.

- The consequences of obesity in adolescence continuing into adulthood are serious, not only because the obesity persists in the majority of cases but also

because some of the complications that manifest in adulthood start in adolescence.<sup>19</sup>

- The degree of obesity is associated with the severity of psoriasis.<sup>15,16</sup> In adults, weight reduction has been shown to improve psoriasis, psoriatic arthritis and treatment responses. It is likely that weight loss could have the same impact for obese or overweight adolescent patients with psoriasis.<sup>20</sup>

## Other Metabolic and Cardiovascular comorbidities

As reported in adults, some publications suggest that there is a link between psoriasis in childhood and adolescence, and dyslipidemia, diabetes, and high blood pressure.<sup>2,15,17,21</sup> There are discussed evidences for these associations, and thus systematic screening for these comorbidities has not been proposed.<sup>16</sup> However, screening must be discussed when there is a family history of comorbidity (familial dyslipidemia) or when a comorbidity is identified following clinical investigation (diabetes, dyslipidemia, or blood pressure).<sup>22</sup>

Dermatologists should also consider assessing comorbidities in adolescents with psoriasis when proposing a treatment that can have an impact on these comorbidities: corticosteroids can induce hyperlipidemia, hyperglycemia, and weight gain; acitretin may lead to hyperlipidemia; cyclosporine can cause hypertension; and tumor necrosis factor (TNF)-alpha inhibitors can result in weight gain.<sup>23</sup>

## Clinical Aspects

### Skin Psoriasis

The clinical picture of psoriasis in childhood resembles that of the adult disease. Plaque psoriasis (Figure 1) is the most frequent clinical type of psoriasis occurring in adolescents. The inverse, palmoplantar, and guttate forms, which are frequent in infants and children, are less common in adolescents.<sup>8–12</sup> Although all clinical types of psoriasis can be observed in adolescents, the pustular, erythrodermic, and linear forms are rare.<sup>23</sup>

Psoriasis plaques in young children are often atypical (small, pink, poorly demarcated lesions with mild scaling) and may resemble the lesions in atopic dermatitis. In adolescents, the plaques usually display typical psoriasis characteristics (monomorphic, sharply demarcated, red plaques covered with grey lamellar scales). The plaques may be localized and only appear in body areas typically affected by psoriasis (such as the elbows, knees, scalp, and umbilicus), but can also be generalized.<sup>23</sup>



**Figure 1** Plaque psoriasis in a 13-year-old boy.

The scalp is often the only location affected by psoriasis in adolescents, leading to misdiagnosis as simple dandruff or tinea capitis.<sup>24</sup> The hairline (Figure 2) and occipital scalp are often the first sites to develop the typical plaque form. Some severe forms can have a pityriasis amiantacea presentation, with thick, fixed, silver scales. In mild forms, scalp psoriasis resembles seborrheic dermatitis. Scalp psoriasis has been associated with an increase in the severity of psoriasis and with the Koebner phenomenon, suggesting a possible role for trauma or scratching in the aggravation of scalp psoriasis.<sup>25</sup> In adults, scalp psoriasis is associated with psoriatic arthritis but there are no data confirming such an association in children or adolescents.

## Nail Psoriasis

Nails are affected in more than one-third of adolescents with psoriasis, mainly with pitting of the fingernails, and onycholysis and pachyonychia of the toenails. Nail involvement has been associated with an increase in the overall severity of psoriasis and psoriatic arthritis.<sup>26</sup> However, although there is a suspected link between nail psoriasis and psoriatic arthritis in adults, the predictive value of nail



**Figure 2** Scalp psoriasis in a 16-year-old boy. This adolescent was suspected of having tinea capitis.

involvement in adolescence for developing psoriatic arthritis in adulthood remains uncertain.<sup>27</sup>

## Psoriatic Arthritis

Psoriatic arthritis affects between 5% and 10% of adolescents with psoriasis.<sup>7-12,14,15,24</sup> Only limited data are available about the distribution of the clinical types of arthritis – peripheral arthritis, spondyloarthropathy, or enthesitis – in this population. As articular pain has

### Box 1 Four-Question Evaluation of Clinical History to Screen for Arthritis in Children with Psoriasis

Do you have swelling and stiffness of the joints?

Do you have difficulty getting up and moving in the morning or after a period of rest?

Do you have any problems performing daily activities or taking part in sport?

Do you find it difficult to hold a pen, or have you developed a swollen 'sausage' finger/toe?

**Notes:** Data from Burden-Teh et al<sup>29</sup> and Coates et al.<sup>30</sup>

a negative impact on the quality of life (QoL), all children and adolescents with psoriasis should be screened for arthritis.<sup>28</sup> A four-question evaluation of clinical history has been proposed to screen for arthritis in children with psoriasis (Box 1). Assessment of adolescents using the Psoriasis Epidemiology Screening Tool (PEST) has also been proposed, together with the referral of patients to a rheumatology department if any signs or symptoms of arthritis are reported.<sup>29,30</sup>

## Health Quality of Life and Psoriasis in Adolescence

Altered QoL is a major concern for adolescents with psoriasis: the disease can have an impact on all aspects of the social life of these patients, including school, sports, social interactions, and sexuality.<sup>31</sup> Studies using classical scoring tools, such as the Dermatology Life Quality Index (DLQI) or the children's version of this tool (CDLQI) adapted to patients aged from 4–5 years to 16 years, have yielded interesting results, showing that QoL scores correlate with disease severity and that the scores improve with successful treatment of the disease.<sup>31–33</sup> However, the validity of these scores in adolescent patients with psoriasis is debatable: the tools are not specific for psoriasis and there is confusion over whether to use the DLQI or the CDLQI for patients aged between 15 and 17 years. Indeed, comparative studies of the CDLQI and the DLQI in patients aged 16 and 17 years have revealed differences between the total scores obtained from the two instruments. A QoL assessment tool dedicated to adolescents with psoriasis, the Adolescent Psoriasis Quality of Life instrument, has recently been developed. The preliminary form of this tool showed promising psychometric properties.<sup>33</sup>

## Evolution of the Psoriasis

### Triggering Factors

Psoriasis flares can be provoked by nonspecific triggers. In children, flares have been noted to occur in association with stress, mild trauma (Koebner phenomenon), and infection (streptococcal or viral). No such associations have been documented for adolescents with psoriasis, with the possible exception to the implication of scratching in the maintenance of scalp psoriasis.<sup>25</sup> Systemic drugs (beta-blockers, lithium, antimalarials, etc.) and HIV infection, are less frequently implicated in the onset of psoriasis in adolescents than they are in adults.

## Outcomes in Adolescents with Psoriasis

Only limited and discordant information is available about outcomes for adolescents with psoriasis. Indeed, previous studies have mainly evaluated outcomes for “child-onset” psoriasis rather than collecting specific data on adolescents with the disease. Nevertheless, recent large-scale studies have provided reassuring data about disease outcomes in adolescents. They suggest that adolescent onset of psoriasis does not influence the prevalence of cardiovascular and metabolic comorbidities, or that of psoriatic arthritis, and does not seem to influence disease severity in adulthood.<sup>9,34,35</sup>

## Social Life and Psoriasis

### School and University

Psoriasis in adolescence has been associated with cognitive impairment, the development of addictions (tobacco, alcohol, and drug abuse), and psychiatric symptoms such as attention deficit disorder or attention deficit hyperactivity disorder.<sup>36–39</sup> These data led to the hypothesis that early psoriasis onset affects the educational development of young patients. In a recent study, our group found that there were no significant associations between early onset of psoriasis and educational level, working activity or living conditions, or with alcohol consumption in adulthood (personal data, submitted for publication). However, vigilance is required concerning the immediate impact of psoriasis on absenteeism, psychological distress, and schooling.

## Extracurricular Activities and Psoriasis

Adolescence is a key period for maintaining or engaging individuals in sporting activities. Participating in sports is widely considered as beneficial for maintaining health and psychological wellbeing during adolescence. However, the impact of skin disease on sporting activity is evaluated in only one question in the DLQI and CDLQI. There can be many reasons why adolescents with psoriasis stop practicing sports, including issues surrounding the psoriasis being visible (for example, when swimming or practicing fighting sports), exacerbation of itchy or painful psoriatic skin by sweat and contact, and psoriatic arthritis limiting sporting activity. Problems may also be associated with psoriasis treatments: oily topical treatments or side effects may be incompatible with practicing sports. Indeed, methotrexate can induce asthenia, and acitretin can induce myalgia or alterations of night vision. A recent case has been reported where an adolescent practicing aviation

refused treatment acitretin because of the risk of alteration of night vision (personal case).<sup>40</sup> The treatments needed to control psoriasis therefore need to be adapted to facilitate sporting activity among adolescent patients, particularly as physical activity seems to have a direct impact on psoriasis, independently of its effect on obesity. The results of a recent study involving adolescents and young adults (mean age: 19 years) indicated that regular physical activity lowers the risk of psoriasis and has a beneficial effect on the natural course of the disease.<sup>41</sup>

## Sex Life, Psoriasis, and Treatments

Sex life, fertility, and contraception are common clinical concerns among adults with psoriasis. However, it can be difficult to discuss these concerns with adolescents because of a reluctance to raise these issues on the part of the adolescent or the dermatologist, or because discussions are hindered by the presence of parents at consultations. Adolescents will most likely be uncomfortable initiating a discussion on these topics and may expect physicians to bring up the subject first. Although these discussions may be initiated by pediatricians or general practitioners, this role often needs to be assumed by dermatologists who can raise these issues in the context of psoriasis and its treatments.

### Sexuality

Psoriasis affects the genital areas in up to 40% of adult patients, impacting QoL and sexual health.<sup>42</sup> There is currently no information about the true frequency of genital involvement in adolescents, with any available data likely to lead to an undervaluation as the CDLQI, unlike the adult version, does not cover sexuality issues. Thus, one way to indirectly assess adolescent sexuality issues might be to offer patients an early adolescent QoL assessment using the DLQI instead of the CDLQI.<sup>32</sup>

### Fertility

The adverse effects of psoriasis and its treatment on future fertility is a major concern for adolescent patients, and, perhaps even more so, for their parents. Although fertility issues are a cause of additional concern during therapeutic management, there is no evidence that fertility is negatively affected by psoriasis.<sup>43</sup> Acitretin has teratogenic potential in females but does not affect fertility. After stopping treatment for 2 to 3 years, the teratogenicity can be considered to be nil. Methotrexate has been associated with impaired fertility in adulthood in males and females.

However, low doses and short-term treatments have been shown to have no impact on fertility.<sup>44</sup> Cyclosporine and biologics have no known impact on fertility. Thus, data on the effect of psoriasis and its treatments on the future fertility of adolescent patients are reassuring.

### Contraception

Contraception has no impact on the course of psoriasis. However, contraception is necessary for female patients using acitretin and is strongly recommended for both males and females using methotrexate and some biologics. These issues should be discussed before initiating treatment with any systemic therapy, particularly in adolescent girls, as the need for contraception may impact the choice of treatment. The choice of a contraception will depend on the preferences of the adolescent and their parents, as well as on ethical considerations and country-specific regulations (for example, in France, parental authorization is not needed before initiating contraception in adolescent girls).

## Adolescent Psoriasis, the Internet and Social Networks

The internet provides information on virtually every possible subject, including all aspects of psoriasis. However, the nature and quality of this information is not controlled.<sup>45</sup> Adolescents have access to this universal data but, unlike their parents and physicians, they may not be able to judge the quality of the information or impose constraints. It is therefore important to discuss these issues with adolescents and possibly guide them to quality sites, such as institutional websites (for example, in France: “Dermato-Info”, <https://dermato-info.fr/fr/les-maladies-de-la-peau/le-psoriasis>; “Resopso”: <https://www.resopso.fr/2018/02/05/psoriasis-chez-lenfant/>) or websites created by patient associations (for example, in France: “France Psoriasis”: <https://francepsoriasis.org/lassociation/documentation/fiches-conseil/le-psoriasis-de-lenfant/>).

Social networks now play a prominent role in the life of adolescents. They can be used as an educational resource, and as a source of psychological and social support. They are tools for sharing and expressing difficulties, anxieties, and life experiences, as well as judgments and criticism. Generally, dermatologists have no access to this information. However, the data collected from these networks are likely to have a strong impact on the decisions made by adolescents regarding their disease and treatments.<sup>45,46</sup> Thus, we must try to identify the false or inappropriate information found by adolescents on

social networks to counterbalance with appropriate information given during consultations. Dermatologists should direct adolescent patients towards associative networks, such as associations of patients that have chat groups for teenage patients (for example, in France, <https://francepsoriasis.org/>).

Adolescents have a tendency to flee from physicians, who represent a form of authority in connivance with their parents. The use of teleconsultations has recently become widespread in some countries during the COVID-19 crisis<sup>47</sup> and could provide a way to narrow the communication gap between physicians and their adolescent patients by finally adapting to the young person's mode of communication. Teleconsultations impose fewer constraints and may facilitate direct communication with the adolescents via a more modern approach. However, although the technical resources for teleconsultations may be available, the tools used to monitor chronic inflammatory dermatoses like psoriasis (severity scores, self-assessment, etc.) need to be improved.

## General Management

Education is always the first step in the management of young patients and should be adapted for adolescents and their parents. Dermatologists should aim to reserve time during consultations for discussions with the adolescent alone, without the parents being present. This dedicated consulting time can be used to discuss difficulties with psoriasis or treatments, or problems with parents and the underlying causes of these issues. Adolescents should also be given key information about their disease. They should be provided with an explanation of the disease pathophysiology and information about outcomes, and informed of the fact that psoriasis is a disease that can be controlled but not cured. They should also be told that psoriasis is not contagious and that no alimentary, sport or vaccine restrictions are necessary, and should also be informed of the aims of the treatments. Although initially very time-consuming, this level of patient education is invaluable for long-term management.<sup>24</sup>

In general, all adolescents with psoriasis will need treatment for all lesions. Assessing the need for treatment and convincing patients to adhere to therapeutic regimens are important issues for all patients, and can be particularly difficult for adolescents. There is no "perfect" argument for convincing patients of the need to initiate and adhere to treatments: treating the disease early does not modify its long-term outcome; the treatments available only manage the symptoms and do not cure the disease; the disease is not lethal; psoriasis requires long-term treatment; and all the treatments

have side effects. Several consultations are often required before the adolescent will be willing to accept the most appropriate treatment, either topical or systemic.

Treatment options include local treatments, phototherapy and systemic treatments (conventional systemic therapy and biologics). In most cases, these treatments are sufficient to control the psoriasis. Subsequent management of adolescents should focus on maintaining therapeutic efficacy and preventing relapses, whilst reducing any treatment-related toxicity to improve patient QoL. This can be considered as "proactive" treatment.<sup>24,48</sup>

One of the major limiting factors in the management of young patients with psoriasis is that some treatments are not licensed for use in adolescents. In France, combined beta-methasone-calcipotriol therapy and methotrexate are not licensed for use in adolescents, and cyclosporine is not licensed for use in patients aged under 16 years. However, in a recent study, we found that up to 100% of adolescents with severe psoriasis had received unlicensed treatments.<sup>49</sup> There are now enough data from registers, cohorts and clinical trials to assess the real-world benefits and tolerance of adult treatments in adolescents.<sup>50-55</sup> In France, treatments can be prescribed for "off-label" use under the following circumstances: 1) there is no alternative licensed drug; 2) the treatment is recognized as effective and safe by the scientific community and literature; 3) the indication is "essential" with regard to the patient's condition, is necessary for the patient, and is consistent with current scientific knowledge; 4) the prescriber has informed the patient of the absence of official authorization for the prescription, the absence of therapeutic alternatives, the expected benefits, and the risks or constraints of the drug, as well as the conditions of health insurance coverage; and 5) justification for the prescription is recorded in the patient's medical file.<sup>48</sup> Recent national guidelines have been published for the management of psoriasis in children and adolescents in Germany, Italy and the United States.<sup>56-58</sup> These guidelines should help improve the care of all young patients with psoriasis worldwide. Overall, nearly all of the therapeutic arsenal used to treat adults with psoriasis can be used in adolescents.

## Specific Physical Conditions of Adolescence and Psoriasis Treatments

Some skin diseases linked to adolescence have to be taken into account before choosing the most appropriate treatment for psoriasis.

- Acne can be induced or exacerbated by the application of topical steroids to the face or scalp (Figure 3), or by the use of cyclosporine. Thus, extra care should be taken when managing adolescents with both acne and psoriasis.
- Striae distensae develop frequently in adolescence. Several risk factors have been identified such as obesity, and rapid variations in weight and height. Another major factor in the development of striae distensae is the chronic use of topical corticosteroids on the same area of skin (Figure 4). This type of use may occur during the treatment of chronic inflammatory skin diseases such as psoriasis. The role of the dermatologist is to reduce this risk in psoriatic patients by prescribing either nonsteroidal treatments or systemic therapies.
- Androgenic alopecia occurs in around 15% of adolescent boys. It is strongly associated with a family history of androgenic alopecia and can severely impair QoL. As acitretin and methotrexate can also induce transient alopecia, these treatments should be avoided in these patients.<sup>59</sup>
- Hair growth is one of the main physical changes occurring in adolescence. Cyclosporine can induce facial hair growth, which may be problematic in adolescent girls with dark hair.<sup>60</sup>

## Topical Treatments

There are no major concerns specifically linked to the use of topical treatments in adolescents, except those concerning topical steroids described in Specific Physical Conditions of Adolescence and Psoriasis Treatments.



**Figure 3** Clobetasol propionate shampoo-induced acne in a 14-year-old girl with scalp psoriasis.



**Figure 4** Severe striae distensae in a 16-year-old girl with psoriasis. The patient received treatment with topical steroids for a long time.

Emollients are an essential part of the long-term care of patients with psoriasis. As in atopic dermatitis, emollient treatment of the areas usually affected by psoriasis reduces the frequency of relapse. In addition, by reducing pruritus, emollients limit the risk of scratching and the Koebner phenomenon on dry skin.<sup>61</sup> The choice of emollient should be made with the adolescent, after discussions to determine the most appropriate product (with or without urea, not too oily, with a pleasant fragrance, etc.).

Topical steroids are the reference treatment for psoriasis, most commonly prescribed as a combination of calcipotriol (50 µg/g) and betamethasone dipropionate (0.5 mg/g).<sup>49,51</sup> These treatments are recommended for skin-limited disease. The potency of the steroids prescribed must be adapted according to disease severity and location. To be effective in plaque psoriasis, topical steroids need to be used over the long term, both to treat symptomatic skin and as preventative treatments. Thus, the duration of the prescription should not be restricted and the treatment should be maintained “until clearing” of the lesions. Several options can be proposed to reduce the frequency and severity of disease relapses after clearing: reducing the use of topical corticosteroids very gradually, using the steroid as a weekend therapy, and ensuring very early treatment of flare-ups (Table 2).<sup>48</sup>

Topical calcineurin inhibitors (tacrolimus or pimecrolimus) can be beneficial for pediatric psoriasis, particularly for sites where there is a risk of atrophy, such as the face. After the lesions have cleared, weekend therapy can be proposed. Dithranol, applied under careful parental supervision, can be used as a short-term therapy. Good results are usually obtained in 70% to 80% of cases.

**Table 1** Management of Adolescents with Psoriasis Using Methotrexate, Acitretin, or Cyclosporine

	<b>Methotrexate</b>	<b>Acitretin</b>	<b>Cyclosporine</b>
Efficacy <sup>a</sup>	30-80% Effective in 1–3 months	60-75% Slowly effective (3 months)	64% Rapidly effective (1 month)
Main contraindications	Renal insufficiency, pregnancy, desire for pregnancy (male and female patients), hepatopathy	Female patients without contraception, pregnancy, severe dyslipidemia, obesity, diabetes, metabolic syndrome, atopic dermatitis, depression	Renal insufficiency, hypertension, cancer history
Treatment associations	Topical therapies Acitretin Biologic systemic therapies	Topical therapies Phototherapy Methotrexate Biologic systemic therapies	Topical therapies
Main toxicity	Hepatotoxicity, cytopenia, chest toxicity, abdominal pain, nausea, loss of appetite, alopecia, asthenia, immunosuppression	Dryness (skin and mucous membranes), teratogenicity, headache, myalgia, photosensitivity	Nephrotoxicity, hypertension, hypertrichosis, gingival hypertrophy, cancer (skin, lymphoma), immunosuppression
Particularities	Effective for most of types of psoriasis The only treatment also effective against psoriatic arthritis	No cumulative toxicity Very effective against pustular psoriasis	Duration of prescription restricted to 1–2 years because of cumulative toxicity
Dosage	10–15 mg/m <sup>2</sup> /week or 0.2–0.4 mg/kg/week	0.25–1 mg/kg/day	2.5–5 mg/kg/day
Evaluations required before initiation	Blood counts, liver function tests, albumin levels, chest radiography	Liver function tests, serum lipid levels, beta-HCG levels	Two blood pressure measurements Serum creatinine levels (twice), tests for proteinuria and creatinine clearance, serum lipid levels Blood counts, urine analysis, electrolyte levels, liver function tests, magnesium and uric acid levels
Follow-up	Every 2 weeks during 2 months, then every month during 6 months, followed by every 2 months and then once a month: <ul style="list-style-type: none"> <li>Blood counts, liver function tests</li> <li>Chest radiography if pulmonary symptoms</li> </ul>	Liver function tests and serum lipid levels: <ul style="list-style-type: none"> <li>1 month after initiation or a dosage increment,</li> <li>Then every 3 months</li> <li>Beta-HCG levels every month</li> <li>No radiological monitoring recommended</li> </ul>	Every 2 weeks during 4 weeks and then once a month: <ul style="list-style-type: none"> <li>Blood pressure measurements</li> <li>Serum creatinine levels</li> <li>After 2 months: <ul style="list-style-type: none"> <li>Blood counts, urine analyses, electrolyte levels, liver function tests, magnesium and uric acid levels</li> <li>Once a year</li> <li>Creatinine clearance</li> </ul> </li> </ul>

**Notes:** <sup>a</sup>Except for methotrexate, not evaluated in prospective studies. Reproduced with permission from Mahé E, Maccari F, Ruer-Mulard M, et al. Psoriasis de l'enfant vu en milieu libéral: les aspects cliniques et épidémiologiques diffèrent des données habituellement publiées. *Ann Dermatol Venerol.* 2019;146(5):354–362.<sup>24</sup>

## Phototherapies

Psoralen–UV-A (PUVA) therapy, UV-B therapy, and local therapy can be proposed for adolescents. There are two major limitations to the use of these therapies in this age group. First, the main limitation is the increased risk of skin cancer and the potential cumulative carcinogenic risk when we offer other potential carcinogenic drugs later

such as cyclosporine and some biologics. For example, cyclosporine is associated with increased risks of non-melanoma skin cancer and photocarcinogenic potential during long-term treatment, particularly in patients who have received high cumulative doses of PUVA (no evidence for UVB therapy).<sup>62</sup> Second, these treatments are frequently incompatible with the daily life of adolescent



**Table 2** Efficacy of Biologics Licensed for Use in Adolescents with Psoriasis: Data from Randomized Studies<sup>a, b</sup>

	Dosage in Clinical Practice	Evaluation at Week 12	
		PASI75	PASI90
Etanercept <sup>63</sup>	0.8 mg/kg/week	56% <sup>c</sup>	25% <sup>c</sup>
Adalimumab <sup>64</sup>	20 mg (15 – <30 kg) or 40 mg (≥30 kg) on D1, every other week starting at W1	57.9% <sup>d</sup>	29% <sup>d</sup>
Ustekinumab <sup>65</sup>	0.75 mg/kg on D1 and every 12 weeks starting at W4	80.6%	61.1%
Ixekizumab <sup>66</sup>	40 mg (≥25 – ≤50 kg), 80 mg (>50 kg), two doses, and then every 4 weeks	90%	83%
Secukinumab <sup>67</sup>	75 mg (<50 kg), 150 mg (≥ 50 kg) every week for 5 weeks, then every 4 weeks	77–93%	67–76%

**Notes:** <sup>a</sup>Meaningful between-study comparisons cannot be made because of differences in inclusion criteria, populations, and study design. <sup>b</sup>The dosage used in clinical practice is not always identical to the dosage used in the clinical studies. <sup>c</sup>In the adolescent group. <sup>d</sup>Evaluation at week 16. Dosage: 0.8 mg/kg. **Abbreviations:** D, day; W, week.

patients, either because of a lack of treatment availability close to home or school or because they interrupt the schooling, family life or sporting activities of the adolescent.

## Conventional Systemic and Biologic Treatments

During the past few years, the number of treatments available for the treatment of psoriasis has increased in some countries. Available treatments may now include conventional systemic treatments, acitretin, methotrexate, cyclosporine, and fumaric acid. Etanercept, adalimumab (two TNF-alpha inhibitors), and ustekinumab (an anti-interleukin-12/23 monoclonal antibody) have now been licensed for use in adolescents with psoriasis for a few years. In 2020, secukinumab, and ixekizumab were licensed in Europe. The choice of treatment depends on several patient-related factors (age, gender, type of psoriasis, comorbidities, etc.), on product availability and their eligibility for reimbursement, on country-specific recommendations or treatment habits, and on the personal experience of the dermatologist. Recent guidelines have been published in Italy, Germany, and the united states for the use of systemic treatments in patients with onset of

**Table 3** Proactive Management Options That Can Be Proposed After Flare-Ups are Under Control, or Used Together with Active Flare-Up Treatments

Education	<ul style="list-style-type: none"> <li>• Explain the pathophysiology and course of psoriasis</li> <li>• Choose treatments (pharmaceutical forms) together with the adolescent</li> <li>• No restrictions to diet, vaccinations or sports are needed</li> </ul>
Avoid factors that aggravate/trigger flare-ups	<ul style="list-style-type: none"> <li>• Avoid injury: onychophagia, scratching, poorly fitting shoes, etc.</li> <li>• Keep vaccinations up-to-date (adapt the schedule in case of vaccine-related flare-ups)</li> <li>• Tonsillectomy, antibiotic prophylaxis if psoriasis flares are linked to infections</li> <li>• Psychological support</li> <li>• Management of obesity</li> <li>• Mediterranean-style diet</li> </ul>
Topical therapy	<ul style="list-style-type: none"> <li>• Emollients</li> <li>• Reduce topical corticosteroid use very gradually</li> <li>• Weekend therapy (topical corticosteroids: calcipotriol or tacrolimus)</li> <li>• Early treatment of flare-ups (topical corticosteroids: calcipotriol)</li> </ul>
Systemic therapy	<ul style="list-style-type: none"> <li>• Subcutaneous treatments: local anesthesia</li> <li>• Acitretin: mucous, semi-mucous and dermal hydration</li> <li>• Methotrexate: folic acid</li> <li>• Effective minimum dose (acitretin, cyclosporine, and methotrexate)</li> <li>• Dosing intervals (adalimumab and ustekinumab)</li> <li>• Weekend therapy (cyclosporine)</li> <li>• Intermittent treatment (cyclosporine and etanercept)</li> </ul>

**Note:** Reproduced with permission from Lavaud J, Mahé E. Proactive treatment in childhood psoriasis. *Ann Dermatol Venerol.* 2020;147(1):29–35.<sup>48</sup>

psoriasis in childhood and adolescence.<sup>56–58</sup> Systemic treatments are summarized in [Table 1](#) and data on the efficacy of biologics in adolescents, obtained from industry-sponsored randomized studies, are summarized in [Table 2](#). Real-life data evaluating other factors, such as comparative drug survival, are now becoming available and will be of use during discussions concerning treatment choices.<sup>50,53</sup>

## Proactive Treatments

Proactive patient management means anticipating disease progression to limit its severity and the occurrence of new flare-ups. This approach must be distinguished from “active or reactive” management given at the time of the active episode,

and also from “prophylactic” management, conducted before onset of the disease. Proactive management plays a key role in the successful treatment of adolescents as it appears to increase adherence to therapeutic strategies, increase patient wellbeing, reduce the burden of the disease and its treatment, and decrease the cumulative toxicity of the treatments. We have recently published a proposed set of proactive measures that can be used in the management of adolescents (detailed in Table 3).<sup>48</sup>

## Conclusion

The role of dermatologists in the management of adolescents with psoriasis is not limited to proposing more recent and effective treatments. These patients require multidimensional and long-term treatment strategies that take into account the particularities associated with this difficult period of personal development and have been adapted to life in the 21st century.

## Disclosures

E. Mahé has paid activities as a consultant, advisor, or speaker for Abbvie, Amgen, Janssen Cilag, Celgene, Leo Pharma, Lilly, and Novartis, and reports no other potential conflicts of interest for this work.

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