

Therapeutics

Effects of minoxidil 2% vs. cyproterone acetate treatment on female androgenetic alopecia: a controlled, 12-month randomized trial

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Summary

Background Hormone studies have demonstrated the androgen-dependent character of female androgenetic alopecia, but there have been few controlled studies of therapies for alopecia in women.

Objectives To compare topical minoxidil 2% and cyproterone acetate in the treatment of female alopecia.

Methods Sixty-six women with female-pattern alopecia were randomly assigned for 12 cycles into two groups, 33 received two local applications (2 mL day⁻¹) of topical minoxidil 2% plus combined oral contraceptive and 33 received cyproterone acetate 52 mg day⁻¹ plus ethinyl oestradiol 35 µg for 20 of every 28 days.

Results A mean reduction of 2.4 ± 6.2 per 0.36 cm^2 in hairs of diameter $> 40 \text{ µm}$ was observed in the cyproterone acetate group ($P = 0.05$) and a mean increase of 6.5 ± 9 per 0.36 cm^2 in the minoxidil group ($P < 0.001$). Comparison of the total number of hairs at 12 months and the body mass index (BMI) revealed a borderline positive correlation in the cyproterone acetate group ($r = 0.39$, $P = 0.06$) and a negative correlation in the minoxidil group ($r = -0.42$, $P < 0.05$). No significant difference was observed in the total number of hairs among cyproterone acetate patients according to the presence or absence of other symptoms of hyperandrogenism, whereas in the minoxidil group, the total number of new hairs was higher in patients with isolated alopecia ($\Delta = 8.1$; $P < 0.05$). Variations in scalp seborrhoea were significant in both groups, but the result was better (for acne and hirsutism as well) in the cyproterone acetate group than in the minoxidil group ($P < 0.001$).

Conclusions Minoxidil treatment was more effective in the absence of other signs of hyperandrogenism, hyperseborrhoea, and menstrual cycle modifications when the BMI was low, and when nothing argued in favour of biochemical hyperandrogenism. Cyproterone acetate treatment was more effective when other signs were present and when the BMI was elevated, factors that favoured a diagnosis of biochemical hyperandrogenism.

Key words: cyproterone acetate, female androgenetic alopecia, minoxidil

While less common in women than in men, androgenetic alopecia is a frequent reason for dermatological consultation. The psychological repercussions of such

alopecia are often serious, especially in young women. Androgenetic alopecia may be either isolated or associated with hyperseborrhoea and other symptoms of hyperandrogenism, acne and/or hirsutism, and menstrual cycle disturbances.

There have been very few studies of the effects of therapies for androgenetic alopecia in women. The

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standard treatment, topical minoxidil, has been shown to have a therapeutic effect, compared with placebo.¹⁻⁷ However, in spite of the androgen-dependent nature of such alopecia, antiandrogen therapies have been employed in only a few, mostly non-randomized, studies of very small series of patients, most often without a control group.⁸⁻¹²

Hormone studies have demonstrated the androgen-dependent character of androgenetic alopecia.^{1,13-16} The severity of such alopecia has been positively correlated with androstanediol glucuronide levels and the body mass index (BMI) and inversely correlated with the level of sex hormone-binding globulin (SHBG), which itself is inversely correlated with the BMI.¹⁶⁻¹⁹

These considerations justified carrying out a randomized study to compare topical minoxidil with cyproterone acetate treatment, and to study the relationship of such therapies with clinical parameters such as the BMI, as well as the presence or absence of other symptoms, such as acne, hirsutism and menstrual cycle disturbances. The present study includes phototrichogram analysis and 12-month clinical evaluations.

Patients and methods

The criteria for inclusion in the study were: age between 18 and 35 years, presence of a female pattern androgenetic alopecia and willingness to participate in the study. The criteria for exclusion were: contraindications for taking cyproterone acetate or combined oral contraceptive, minoxidil therapy during the 3 months preceding the study, postmenopausal women, women in the immediate postpartum period (6 months), women presenting male-pattern alopecia, alopecia associated with hypothyroidism (thyroid-stimulating hormone >4 IU L⁻¹), hyperprolactinaemia (with amenorrhoea and/or pituitary microadenoma or macroadenoma), Cushing's disease or syndrome, and major iron deficiencies (low serum iron and/or haemoglobin <10 g dL⁻¹). None of the patients had been receiving hormone treatment, including oral contraceptives, for at least 3 months immediately prior to investigation.

The study was approved by the local ethics committee in accordance with the guidelines published in the Declaration of Helsinki, and prior informed consent was obtained from all patients.

Over a 6-month period, from July 1993 through November 1995, 66 women patients with female-pattern alopecia were enrolled in the study. All had

been referred to our teaching hospital endocrinology service by dermatologists. Their alopecias were graded according to Ludwig's classification.²⁰ Patients' menstrual cycle abnormalities were noted. Other clinical signs consistent with hyperandrogenism, such as acne and hirsutism, were evaluated by a dermatologist.

Phototrichograms

A phototrichogram of the anterior vertex, using an immersion technique, was taken prior to the start of treatment on day zero (d_0), after which a 6×6 mm square area (0.36 cm²) of the least densely implanted frontoparietal zone was marked with semipermanent tattoo dots, shaved with a small razor, and all hair in it counted.^{21,22} A second phototrichogram was then taken under reproducible standard conditions of distance, lighting and magnification ($\times 3$) on day 2 (d_{0+2}), using a calibrated mark on a transparent scale corresponding to a diameter of 40 μ m. This procedure was repeated at 6 and 12 months of treatment (M_6 and M_{12}). Parameters evaluated were the number of hairs >40 μ m in diameter as the primary outcome measurement corresponding to a significant cosmetic effect, the total number of hairs and the number of hairs in the anagen and telogen phases as secondary outcome parameters. Upon completion of the study, all phototrichograms were read in a blind manner by two independent dermatologists. Conflicting results between the two primary dermatologists were agreed with a third dermatologist.

The cosmetic effectiveness of treatment received was evaluated by the patients themselves, who cited hair loss and degree of seborrhoea on visual analogue scales of 1-100 mm at the beginning and end of the study.

We had intended to analyse only the results of patients who fully completed the study; however, in cases in which the final measurements at M_{12} were not carried out, the last documented measurement after day zero (M_6) was taken as the final measurement.

Treatment

Patients were randomly assigned to one of two groups with stratification every six patients. The first group ($n = 33$) received morning and evening local applications (2 mL) of topical minoxidil 2% in association with combined oral contraceptive consisting of ethinyl oestradiol 30 μ g and gestodene 75 μ g day⁻¹ for 21 of 28 days (Moneva[®], Schering Laboratories, Levallois-Perret, France). The second group ($n = 33$) was treated

with cyproterone acetate (Androcur®; Schering Laboratories) 50 mg day⁻¹ for 20 of 28 days, plus a combination of ethinyl oestradiol 35 µg and cyproterone acetate, 2 mg day⁻¹ (Diane 35®; Schering Laboratories) for 21 of 28 days. Both groups were treated for 12 cycles.

Statistical analysis

The number of subjects to include was calculated for a difference of seven hairs per 0.36 cm², with α and β risk errors of 5%. This was 26 subjects in each group; we recruited 33 subjects in each group in anticipation of patients who dropped out.

Qualitative variables were analysed for intergroup comparisons using the χ^2 test (or Fisher's exact test if one of the expected values was less than 5). Quantitative variables were compared using Student's *t*-test (a variance ratio test was used to check whether the values in the two treatment groups had similar variances). The significance of variations in phototrichogram parameters between the beginning and end of treatment obtained with Student's *t*-test was compared with that obtained using the Wilcoxon test. For intragroup comparisons, qualitative variables were analysed with the χ^2 test for paired series and quantitative variables, using the paired *t*-test or the Wilcoxon test. Correlations were sought using a simple linear regression. Results are expressed as means plus or minus standard deviation and were considered to be significant for $P < 0.05$. In the results, the variations observed at different times in the same patient are indicated by Δ , and differences between two groups of subjects are indicated by δ . The analysis was carried out using StatView F-4.5 software (Abacus Concepts Inc., CA, U.S.A.).

Results

The 66 patients were aged 26.4 ± 4.8 years (range: 18–34 years), 25.7 ± 4.7 in the cyproterone acetate group vs. 27.1 ± 4.4 in the minoxidil group. Their alopecias were graded according to Ludwig's classification²⁰ as follows: grade I—67%; grade II—31%; and grade III—2%; $n = 15/12/0$ in the cyproterone acetate group vs. $n = 20/8/2$ in the minoxidil group, respectively. The mean duration of alopecia was 5.5 ± 4.2 years. Mean patient weight was 62 ± 11 kg, 61 ± 11 in the cyproterone acetate group vs. 62 ± 10 in the minoxidil group, height 163 ± 5 cm, and BMI 23.3 ± 4.4 kg m⁻². At d_0 , no statistical difference

was noted for age, degree of alopecia, BMI, association with other symptoms of hyperandrogenism, seborrhoea or menstrual disturbances. Classified as the presence or absence of acne and/or hirsutism, these symptoms were observed in 61% of the cyproterone acetate patients and in 70% of the minoxidil patients. At the time of inclusion in the study, when the two groups were statistically comparable, 58% of the patients assigned to the cyproterone acetate group presented menstrual cycle irregularities, vs. 61% of the patients assigned to the minoxidil group, but only three patients had oligomenorrhoea.

The effects of treatment were based on phototrichogram data. Sixty-six patients were enrolled and randomized in two groups of 33 subjects. In each group, 32 received the allocated treatment; one subject in each group left the study between the phototrichogram and the beginning of the treatment. At M_6 , 30 had the phototrichogram in the cyproterone acetate group and 28 in the minoxidil group. At M_{12} , 25 had the phototrichogram in the cyproterone acetate group and 27 in the minoxidil group. We were able to analyse the results obtained from the last measurement in 58 of the 66 patients (30 in the cyproterone acetate group and 28 in the minoxidil group), who were evaluated at least once in addition to d_0 . A total of 12 patients left the study after the beginning of the treatment, seven in the cyproterone acetate group and five in the minoxidil group. In the cyproterone acetate group, two left the study because of dyspareunia, two for weight gain, one for migraine headache and two without stating a reason. In the minoxidil group, three left the study because of the restrictive nature of the treatment, one for mastodynia and one for nausea. At each time, d_0 , M_6 and M_{12} , we calculated the δ -values between groups from all patients who completed the phototrichogram. In each group, calculation of the Δ -values were also done in all patients who completed the phototrichogram between d_0 and M_6 , and between d_0 and M_{12} .

Variations in the number of hairs > 40 µm

Intergroup comparison. The two groups were comparable on d_0 ($P = 0.33$), at M_6 and at the time of the last set of measurements taken during the treatment period (Table 1). The two groups were also considered comparable ($P = 0.30$ at M_6 and $P = 0.23$ at the time of final measurement). The degree of significance of the difference reached 0.04 at M_{12} . Comparison of the means at the beginning and end of treatment between

Table 1. Number of hairs of diameter > 40 µm per unit of surface area (D > 40 µm) and total number of hairs per unit of surface area (0.36 cm²) in each therapeutic group (minoxidil and cyproterone acetate) at different times of treatment

	d ₀ (n)	M ₆ (n)	M ₁₂ (n)	Δ M ₀ /M ₁₂ (n)	Δ last/first measurement (n)
No. of hairs of D > 40 µm minoxidil group	53.3 ± 18.7 (33)	57.7 ± 15.4 (28)	58.2 ± 15.3 (27)	6.4 ± 9.0 (27)	6.5 ± 8.8 (28)
Total no. of hairs per 0.36 cm ² minoxidil group	67.4 ± 19.4 (33)	73.2 ± 17.2 (28)	73.5 ± 16.9 (27)	7.9 ± 9.4 (27)	7.7 ± 9.3 (28)
Total no. of hairs per 0.36 cm ² cyproterone acetate group	71.6 ± 17.6 (33)	70.6 ± 17.2 (30)	68.8 ± 14.0 (25)	0.5 ± 7.0 (25)	-0.2 ± 6.7 (30)

n, no. of patients.

the two treatment groups yielded significantly different results ($P < 0.001$, Wilcoxon test). This significant difference corresponded to an increase in the number of hairs > 40 µm diameter in the minoxidil group, a value that remained stable in the cyproterone acetate group.

Intragroup change. At the time of the final measurement, the mean reduction in the number of hairs > 40 µm was at the limit of statistical significance in the cyproterone acetate group ($P = 0.05$). At that same time, a mean increase of hairs > 40 µm was found in the minoxidil group, which is statistically significant ($P < 0.001$).

Variation in the total number of hairs per unit of scalp surface area

The total number of hairs and the number of hairs of > 40 µm diameter in the two therapeutic groups were found to be closely correlated ($r = 0.85$, $P < 0.001$) (Table 1). The change (Δ) in the total number of hairs and in hairs of > 40 µm diameter is also highly correlated, with $r = 0.84$ ($P < 0.001$). These two evaluation criteria are therefore equivalent in practice. Intergroup comparison indicated a significant difference in the variation in each group (Δ) of total number of hairs between the beginning and the end of treatment ($P < 0.001$). At the last measurement, the mean number of hairs in the cyproterone acetate group was found to be stable ($P = 0.85$) and increased in the minoxidil group ($P < 0.001$).

Number of anagen-phase hairs. Intergroup comparison of the total number of anagen-phase hairs indicated a significant difference in the variation within each group between the beginning and end of treatment ($P < 0.001$), revealing stability in the cyproterone acetate group $\Delta = -2 \pm 7$ and an increase in the minoxidil group $\Delta = 9 \pm 11$ ($P < 0.001$) at the last measurement. The mean numbers of anagen-phase

hairs at the time of inclusion in the study were found to be statistically comparable for this parameter at d₀, M₆, M₁₂ and at the last measurement ($P = 0.16$, 0.58 , 0.11 , 0.36 , respectively).

Number of telogen-phase hairs. The number of telogen-phase hairs did not vary significantly between the beginning and the end of the study within either treatment group. The intergroup comparison did not indicate any difference between the two groups: $\Delta = 2 \pm 6$ in the cyproterone acetate group and $\Delta = -1 \pm 6$ in the minoxidil group at the last measurement.

Percentage of anagen-phase hairs/the total number of hairs. A slight, statistically non-significant ($P = 0.28$) mean decrease in this ratio, $-2 \pm 8\%$, was observed in the cyproterone acetate group, and a statistically non-significant increase of $3 \pm 9\%$ ($P = 0.07$) was found in the minoxidil group. The two groups were found to be comparable at d₀, M₆, M₁₂ and at the time of final measurement. Comparison of variation (Δ) between the two groups showed a non-significant ($P = 0.06$) difference with the Wilcoxon test.

Relations with other clinical parameters

Results as a function of the presence or absence of other manifestations of hyperandrogenism. The results differed according to the therapeutic group and the presence or absence of other manifestations of hyperandrogenism (acne and hirsutism). Thus, no significant difference was observed in the total number of hairs of patients in the cyproterone acetate group according to whether or not other symptoms of hyperandrogenism were present ($\delta = 2.6$), whereas in the minoxidil group, the total number of hairs was much higher in patients in whom alopecia was the only symptom than in those in whom it was associated with other symptoms ($\delta = 8.1$;

$P < 0.05$). This difference was also noted according to the presence or absence of menstrual cycle irregularities. Indeed, when there were such irregularities, intergroup comparison of the results observed with both types of therapy were equivalent, with an increase of 2.4 ± 5.1 in the total number of hairs in the cyproterone acetate group and 2.4 ± 3.6 in the total number of hairs in the minoxidil group, whereas in the absence of menstrual cycle irregularities, the minoxidil group had a much stronger therapeutic response ($\Delta = 10.2 \pm 10.1$) than the cyproterone acetate group did ($\Delta = -1.7 \pm 9.0$).

In intragroup comparison. The results were better in cyproterone acetate group patients who had menstrual cycle irregularities than in those who did not ($\delta = 4.0$), even though this difference was not statistically significant; however, in the minoxidil group we noted that regrowth was better when menstrual cycle irregularities were absent ($\delta = 7.9$) ($P < 0.05$).

Results as a function of body mass index. The effects of treatment on the total number of hairs and on the number of hairs of diameter $> 40 \mu\text{m}$ were strongly linked to the BMI in both groups. Prior to treatment, no correlation was detected between the total number of hairs and the BMI in either group. However, at M_6 , and even more at M_{12} , a positive or negative correlation for these parameters was found in both groups, with a very significant difference between the two groups ($P < 0.001$). Analysis of the total number of hairs at M_{12} vs. BMI in both groups prior to treatment revealed a borderline positive correlation in the cyproterone

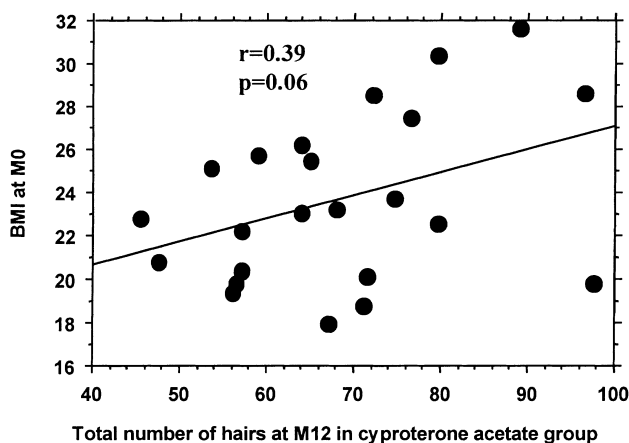


Figure 1. Correlation between the total number of hairs at 12 months and the body mass index (BMI) before treatment in patients treated with cyproterone acetate ($P = 0.06$).

acetate group ($r = 0.39$, $P = 0.06$) (Fig. 1) and a negative correlation in the minoxidil group ($r = -0.42$, $P < 0.05$) (Fig. 2).

Estimation of hair loss and seborrhoea

Self-estimation of hair loss by patients prior to treatment, quoted on a scale of 1–100 mm yielded comparable results in both groups, with a mean of 64 ± 19 mm for cyproterone acetate ($n = 33$) and 70 ± 17 mm for minoxidil ($n = 33$) ($P = 0.16$). On a scale of 1–100 mm following treatment, large mean decreases in hair loss were observed in both groups: -24 ± 26 mm for cyproterone acetate ($n = 25$) and -28 ± 24 mm ($n = 28$) for minoxidil. These reductions were statistically significant for both groups ($P = 0.001$). The reduction was even more marked in patients who continued their treatments through M_{12} .

Self-evaluation of scalp seborrhoea by patients prior to treatment was similar in the two groups, with a mean of 64 ± 28 mm in the cyproterone acetate group ($n = 33$) and 65 ± 25 mm in the minoxidil group ($n = 33$) ($P = 0.87$). Decreases were statistically significant in both groups, but greater in the cyproterone acetate group, with a mean self-evaluation of -29 ± 33 mm for the cyproterone acetate group ($n = 25$) ($P = 0.001$) and of -9 ± 17 mm for the minoxidil group ($n = 28$) ($P < 0.01$). Comparison of the results of seborrhoea self-evaluation between the two patient groups was statistically significant at M_{12} , with a mean of 33 ± 19 mm in the cyproterone acetate group vs. 58 ± 25 mm in the minoxidil group ($P < 0.001$).

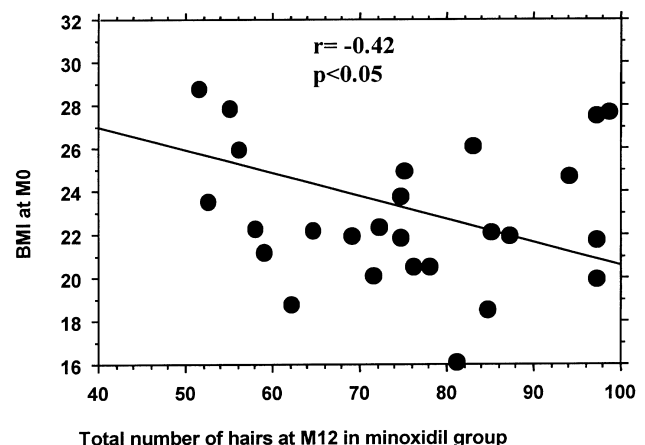


Figure 2. Correlation between the total number of hairs at 12 months and the body mass index (BMI) before treatment in patients treated with minoxidil ($P < 0.05$). Comparison between the two therapeutic groups is highly significant ($P < 0.001$).

Variations in other symptoms of hyperandrogenism

Classified as the presence or absence of acne and/or hirsutism, these symptoms were observed in 61% ($n = 20$) of the cyproterone acetate patients and in 70% ($n = 23$) of the minoxidil patients. At the twelfth month, manifestations of hyperandrogenism were noted in only 12% ($n = 3$) of the cyproterone acetate group, vs. 56% ($n = 15$) of patients on minoxidil. This favourable change in both groups was clearly different in the two groups ($P < 0.01$). On the other hand, this change was reversed for menstrual cycle irregularities. Indeed, at the time of inclusion in the study, when the two groups were statistically comparable, 59% ($n = 19$) of the patients assigned to the cyproterone acetate group presented menstrual cycle irregularities, vs. 67% ($n = 22$) of patients assigned to the minoxidil group. Intragroup evaluation at the end of treatment revealed a statistically significant improvement in menstrual cycle irregularities among the minoxidil patients, only 7% ($n = 2$) of whom continued to present such symptoms ($P = 0.01$). A decrease in the frequency of menstrual cycle irregularities was noted in patients in the cyproterone acetate group, but at the end of treatment, 44% ($n = 11$) of them still presented menstrual cycle irregularities, which was not statistically significant. Comparison of these symptoms in the two groups revealed a lower frequency in the minoxidil group ($P < 0.01$).

Finally, three patients had scalp pruritus during treatment with minoxidil. Variations in weight were not statistically significant; they were 1 ± 4 kg in the cyproterone acetate group vs. 1 ± 3 kg in the minoxidil group.

Discussion

This is the first controlled study comparing treatment of androgenetic alopecia with topical minoxidil and cyproterone acetate. Combined oral contraceptive therapy was associated in both treatment groups in order to provide contraception and an oestrogen supply. The study took into account both the objective values measured in the phototrichogram and subjective values, such as the effects of treatment on seborrhoea, self-assessment of hair loss, and other symptoms often associated with hyperandrogenism. Final evaluation of treatment after 12 therapeutic cycles minimized seasonal influences on the evaluation criteria. Analysis of phototrichogram data demonstrated better results with minoxidil than with cyproterone acetate. Evidence of

this was seen in the increased numbers of hairs of diameter $> 40 \mu\text{m}$ and in the total number of hairs in this group, whereas these same parameters remained stable without a significant increase for a year in the cyproterone acetate group. The minoxidil data showing an increase in the total number of hairs are quite similar to those reported in the literature for controlled studies vs. placebo, as well as for studies employing phototrichogram analysis.^{2-7,23,24}

Studies carried out with cyproterone acetate are far less numerous. In a retrospective study, Peereboom-Wynia *et al.*¹² compared the results of cyproterone acetate with those of an untreated control group. The cyproterone acetate dose administered was lower than in our study; their patients received 20 mg day^{-1} on 15 days per treatment cycle, whereas our patients received 52 mg day^{-1} on 20 days per treatment cycle. In the trichogram, an increase in the number of anagen hairs was observed in the experimental group, whereas a simultaneous decrease in the number of anagen hairs was found in the control group. However, the trichogram data were significant only in the frontal region; not in the temporal region. Our results appear to be different, as the total number of hairs and number of anagen hairs remained stable in the cyproterone acetate group. However, our study was prospective, not retrospective. This observed difference might also be due to the more posterior localization and less sensitive localization of the phototrichograms in our study for cosmetic reasons, than the trichogram in the Peereboom-Wynia *et al.*¹² study, which was carried out in the frontal region.

In another study, which followed the reversed scheme of Hammerstein, the total dose per cycle was comparable with the one we used, i.e. 100 mg day^{-1} on 10 days per treatment cycle, resulting in a positive effect on the total number of hairs.⁸ In the study of Mortimer *et al.*,¹⁰ which also used the Hammerstein scheme, positive subjective effects on alopecia were also observed; however, only three subjects underwent phototrichograms at the beginning, middle and end of treatment.

The subjective results obtained in our study contrasted with the phototrichogram data. In fact, analysis of the visual analogue scale at the beginning and end of treatment indicated comparable effects in the two therapeutic groups. This absence of difference was probably related to the beneficial effect of cyproterone acetate on seborrhoea, which was minimal with the combined minoxidil and contraceptive treatment. The cosmetic result was thus similar in the two treatment

groups. The other studies dealt only with the subjective effects of treatment, resulting in 50% of the patients studied reporting improvement.^{9,25} However, a reduction in greasiness with subjective cosmetic changes should not be confused with real hair growth.

It is especially important to note that therapeutic responses were not homogeneous among all the patients we studied. The therapeutic benefit in the minoxidil group was proportionally greater when alopecia was the only symptom of hyperandrogenism in the absence of menstrual cycle irregularities, resulting in a similar effect, whatever the degree of severity of alopecia prior to treatment. In the minoxidil group, patients presenting other symptoms of hyperandrogenism, particularly menstrual cycle irregularities, responded in a manner comparable with that observed in patients treated with cyproterone acetate. The therapeutic benefit found in the minoxidil group was no longer obvious in these patients. The therapeutic effect on patients using minoxidil was better in proportion with a lower BMI. The opposite was observed in patients taking cyproterone acetate. However, the BMI was inversely correlated with the SHBG level and positively correlated with plasma androstenediol glucuronide and dehydroepiandrosterone levels.^{16–19} Also, patients with an elevated BMI, a low SHBG level and greater free androgen activity responded well to antiandrogen treatment. If the BMI was low, the SHBG high, and peripheral androgen activity weak, the response to antiandrogen treatment was not as good. With minoxidil, these observations were reversed: with an elevated BMI, low SHBG and strong free androgen activity, treatment was less effective than with a low BMI, elevated SHBG and weak androgen activity.

On the other hand, the benefit with respect to other symptoms of hyperandrogenism produced by cyproterone acetate was clearly greater than in the minoxidil group. The effects on menstrual cycle irregularities should also be taken into consideration. However, whereas such irregularities persisted much more frequently in the cyproterone acetate group, this phenomenon was related to the existence of amenorrhoea without other anomalies in many patients.

Conclusions

When phototrichogram data are taken into account, the overall therapeutic effect was better in the minoxidil group than in the cyproterone acetate group. On the other hand, because of the effect on seborrhoea observed in the cyproterone acetate group, which

was weak in the minoxidil group, the cosmetic effect was quite similar in the two groups. Overall, the observations are consistent. The cosmetic effect depends on the regrowth of hair, but also on the effect on seborrhoea. This indicates that the points of impact of the two treatments are probably different. The benefit in the minoxidil group was proportionally greater when alopecia was an isolated symptom and when there were no other signs of hyperandrogenism, no hyperseborrhoea, no modification in the menstrual cycle, when the BMI was low, and when there was nothing arguing in favour of biochemical hyperandrogenism. In addition, there were no notable therapeutic effects on the other symptoms. On the other hand, cyproterone acetate treatment is preferable when other signs of hyperandrogenism are present, such as hyperseborrhoea, menstrual cycle irregularities and an elevated BMI, all of which are factors arguing in favour of biochemical hyperandrogenism. cyproterone acetate treatment resulted in good therapeutic effects on the other symptoms of hyperandrogenism. Finally, the different points of impact of the two types of treatment suggest the possibility that treatment combining cyproterone acetate and topical minoxidil could produce more effective results on all clinical symptoms.

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