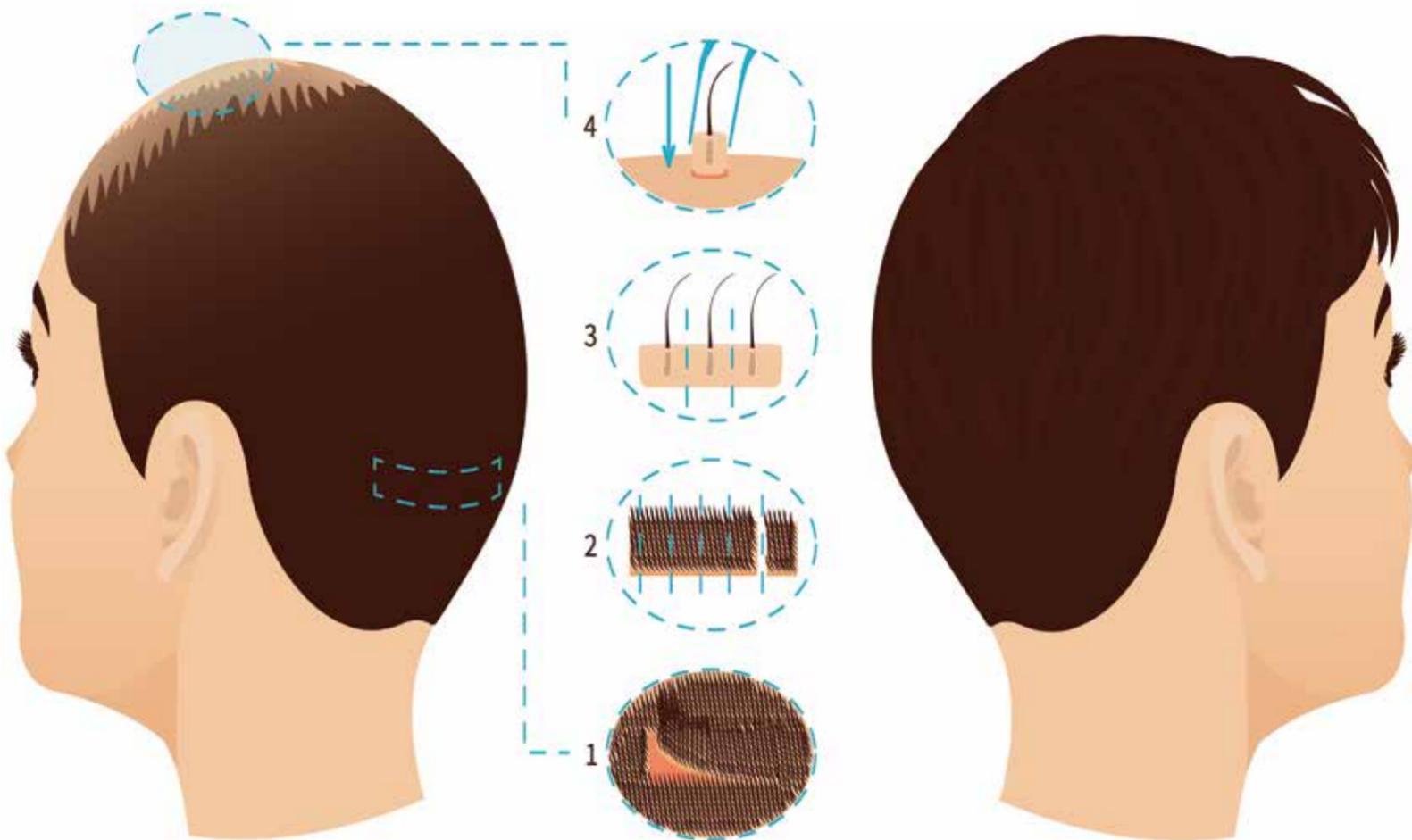


# How to Treat

PULL-OUT SECTION

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## Hair restoration

### Background

It is easy to underestimate the impact of hair loss on men and women (see figure 1). Hair transplantation was first performed by Dr Shoji Okuda in Japan just prior to World War II and popularised by Dr Norman Orentreich from the US in the 1960s.<sup>1,2</sup> In a series of experiments, Orentreich demonstrated the principle of donor dominance that states that the behaviour of transplanted hairs is determined by the characteristics of the donor site rather than the recipient site. Donor hair follicles transplanted from balding vertex scalp onto non-bald skin continue to miniaturise in synch with follicles on the vertex scalp. Donor hair follicles transplanted from non-balding occipital scalp onto bald vertex scalp continue to grow in synch with follicles on the occipital scalp.

The principle of donor dominance has formed the basis of therapeutic hair transplantation to treat men and women with patterned hair loss. Orentreich used 4mm punch grafts from non-bald scalp to fill in bald frontal and vertex scalp.

In the 1980s Dr Richard Shiell



Figure 1.  
A 25-year-old man before, and nine months after 2000 follicular unit grafts.

from Melbourne pioneered follicular unit transplantation.<sup>3</sup> This procedure involves excision and primary closure of a thin, 10cm long strip of skin from the occipital scalp, microdissection of the strip into individual follicle units and then implantation one-by-one into the bald scalp. This became the dominant procedure for the next 30 years. Significant refinements included the trichophytic closure to improve the donor scar, better understanding of the optimal donor site, better handling of follicles with improved implantation techniques to increase graft survival and better understanding of the intricacies of

the anterior hair line to improve the aesthetics of the final result.

In 2000 Dr Ray Woods from Sydney described a modified technique that later became known as follicular unit extraction.<sup>4</sup> This involves harvesting donor follicles with a 0.75mm punch biopsy, further microdissection of the punch tissue into individual follicles and then implantation into bald scalp. The donor site is left to heal by wound contraction and secondary intention. The lack of a linear occipital scalp is attractive to men who have short hair, and follicular unit extraction now accounts for around 60% of hair transplants in men in Australia.

In contrast, follicular unit transplantation accounts for over 95% of transplants in women, whose longer hair conceals the scar.<sup>5</sup>

Significant advances in the medical treatment of male and female pattern hair loss over the past 15 years have further improved the surgical outcomes, the longevity of transplanted follicles and patient satisfaction with the procedure.

Today, men and women with advanced androgenetic alopecia can be managed effectively with a combination of medical therapy and hair transplantation surgery.

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Patterned hair loss

**Epidemiology**

ANDROGENETIC alopecia affects all men and all women progressively as they age. There is no 80-year-old man or woman who has the same amount of scalp hair that they had when they were 18.

The age of onset and rate of progression varies considerably from person to person, while the pattern of hair loss in men (male pattern hair loss) and women (female pattern hair loss) are relatively constant.

Premature hair loss is defined as hair loss that exceeds normal age-related androgenetic alopecia. Premature hair loss is an indicator of premature ageing and reduced longevity.<sup>6</sup> Premature hair loss may also diminish physical attractiveness.

In men, premature balding is commonly an unwelcome and stressful event. In women, even normal age-related hair loss is commonly unwelcome and stressful. Many women in their 80s and 90s still go to extreme lengths to conceal age-related androgenetic hair loss.

To define the prevalence of female pattern hair loss, one of the authors developed and validated a clinical grading scale for female pattern hair loss (FPHL) and performed a population-based survey (see figure 2). The age-adjusted prevalence of female pattern hair loss (stage 2-5) in the community is 32.2%, 10.5% of whom have moderate to-severe hair loss (stages 3-5).<sup>8</sup> In Australia, with a population of 24 million, this equates to over four million women with mild FPHL and 1.2 million women with advanced FPHL.

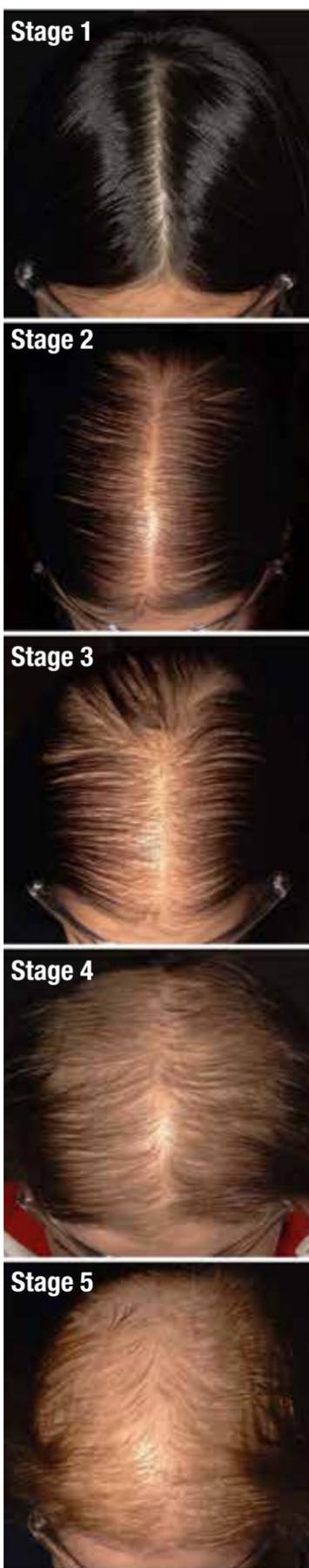
To define the prevalence among Australian males, one of the authors also developed and validated a clinical grading scale for male pattern hair loss (see figure 3).<sup>7</sup> The age-adjusted prevalence of mid-frontal and vertex scalp hair loss (stages 3-5) was 44.9%. The prevalence increased with age. Only 4.1% of men aged 80 or older had no visible hair loss. This equates to about six million balding Australian men.<sup>8</sup>

**Aetiology**

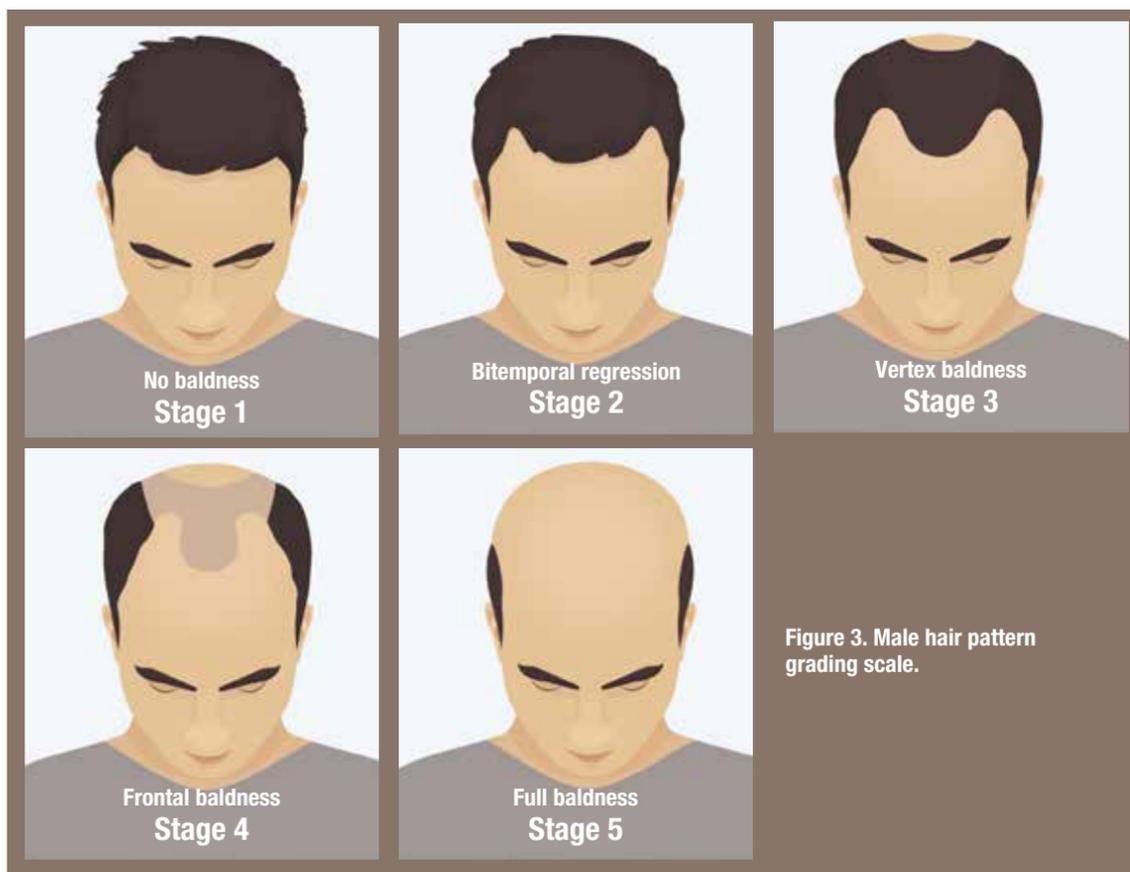
Twin studies performed in Queensland confirm that premature androgenic alopecia has a polygenetic aetiology.<sup>9</sup> The first gene for androgenetic alopecia was discovered in the 1990s by researchers from the University of Melbourne.<sup>10</sup> Genetic polymorphism of the androgen receptor gene, which is found on the X chromosome, were found to be associated with premature baldness in young men.

Two further genes, the oestrogen receptor beta gene and the aromatase gene, are associated with female pattern hair loss.<sup>11</sup> These genes are involved in androgen signalling and metabolism in the hair follicles.

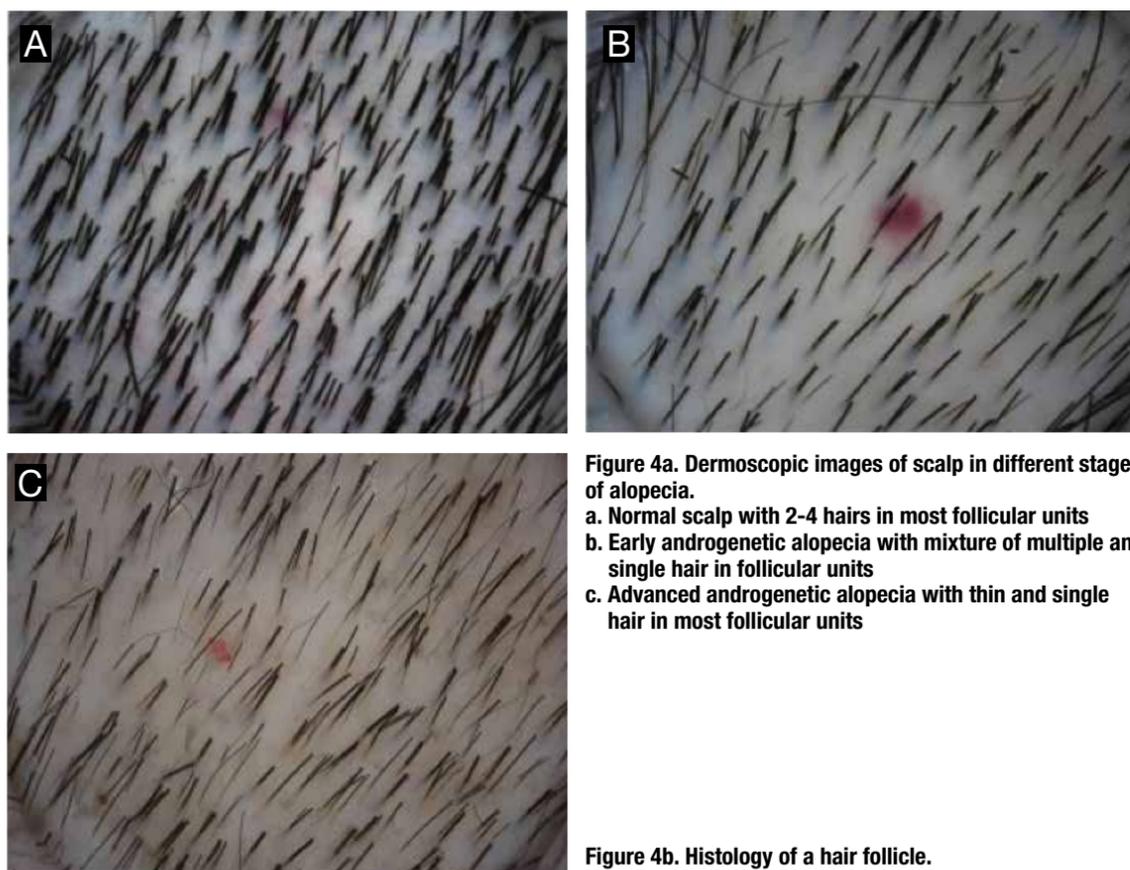
Epigenetic silencing of the androgen receptor gene on the occipital scalp protects these follicles from the balding process.<sup>12</sup>



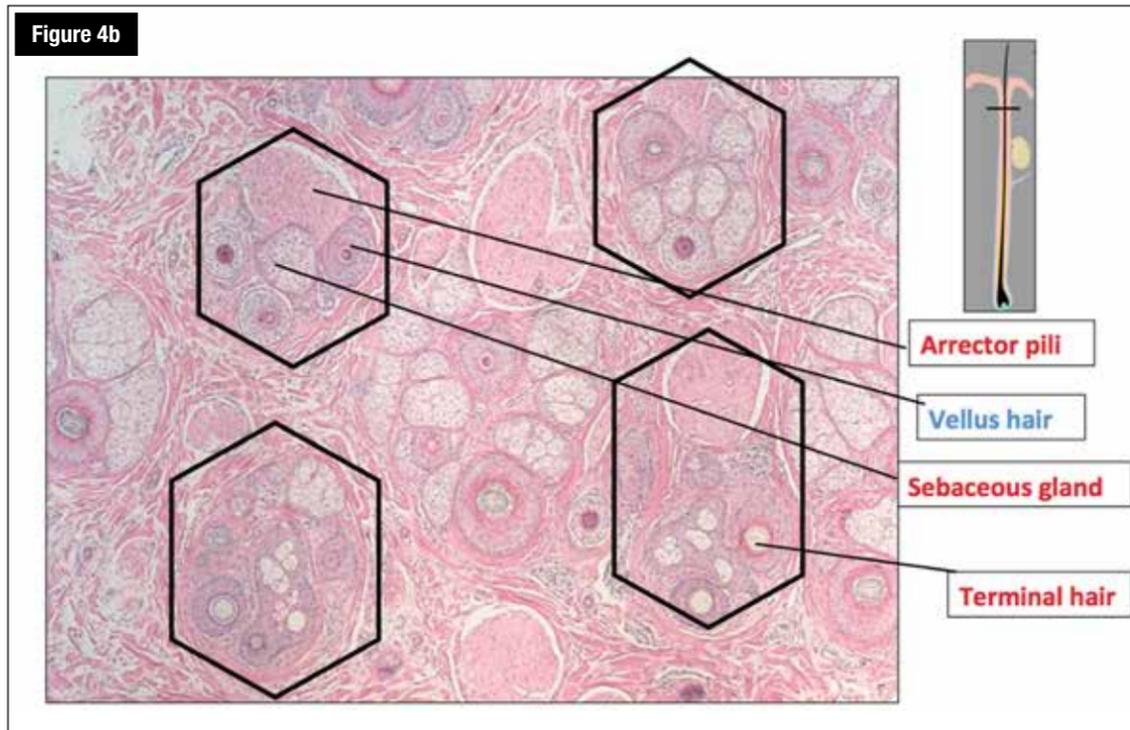
**Figure 2. Sinclair scale.** Stage 1 is normal. Stage 2 shows widening of the midline part. Stage 3 correlates with Ludwig stage I. Stages 4 and 5 correlate with Ludwig stage II. As Ludwig III is rarely seen in clinical practice it was not included in this grading scale.



**Figure 3. Male hair pattern grading scale.**



**Figure 4a. Dermoscopic images of scalp in different stages of alopecia.**  
 a. Normal scalp with 2-4 hairs in most follicular units  
 b. Early androgenetic alopecia with mixture of multiple and single hair in follicular units  
 c. Advanced androgenetic alopecia with thin and single hair in most follicular units



**Figure 4b**

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# How to Treat – Hair restoration

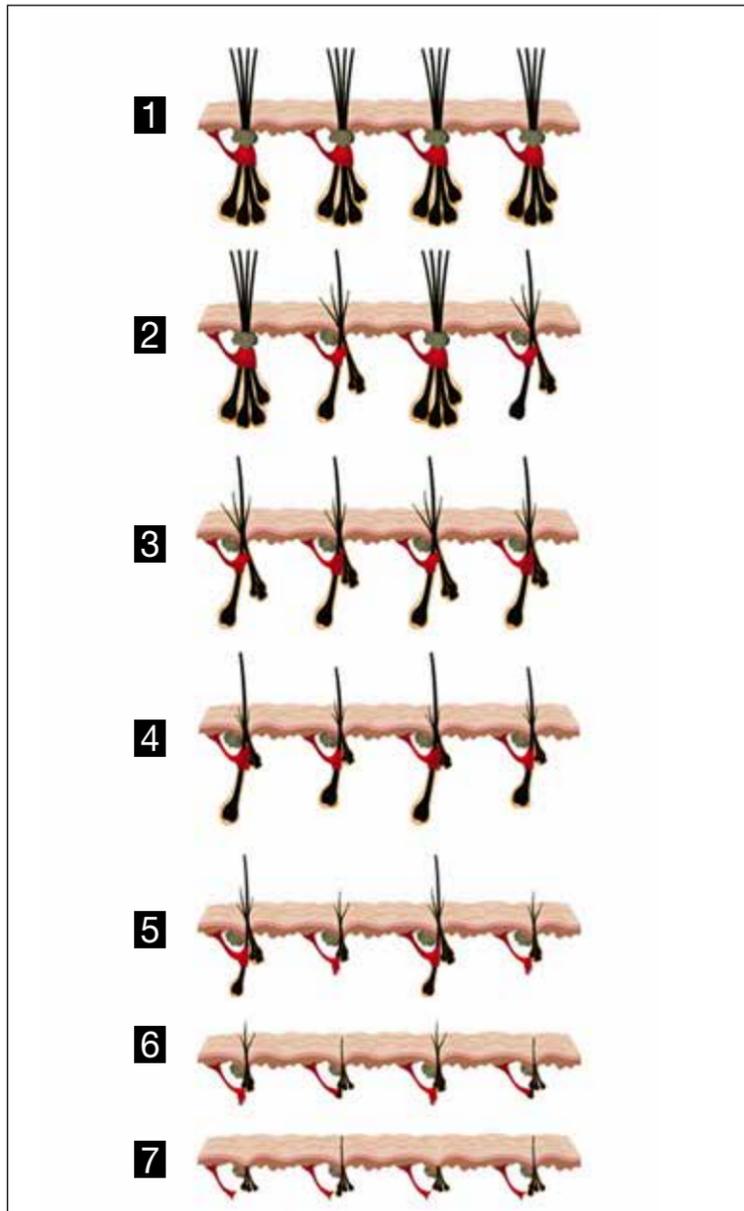
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## Pathogenesis

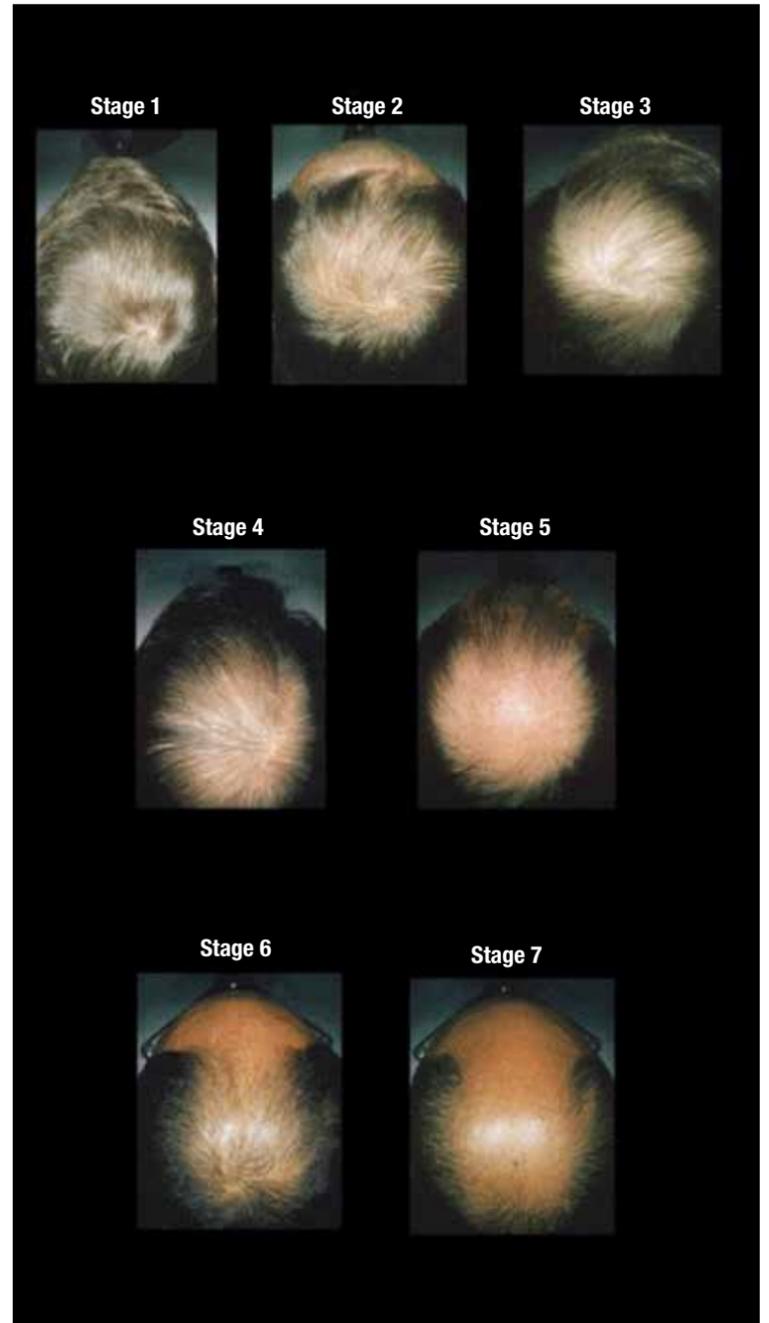
Hair on the scalp grows differently from hair elsewhere on the human body.<sup>13</sup> Body hairs arise from simple pilosebaceous units that comprise one hair follicle, one arrector pili muscle and one sebaceous gland. Scalp hairs are tufted and arise from complex pilo-sebaceous units comprising one primary hair, up to five secondary hairs that bud off the side wall of the primary follicle, a single sebaceous gland and a single arrector pili muscle (see figures 4a and 4b). The arrector pili muscle attaches circumferentially around the primary follicle and to the side wall of the secondary follicles.

The initial loss in androgenetic alopecia is due to miniaturisation of secondary follicles over the frontal and vertex scalp (see figure 5). Miniaturised follicles produce rapidly cycling miniaturised hairs. This leads to a diffuse reduction in hair density without visible baldness. It may present with increased hair shedding and people with long hair may notice a reduction in the diameter of their pony tail. This may precede the appearance of bald scalp by a number of years.

Baldness occurs when all the hairs within a complex pilo-sebaceous unit have miniaturised to the point of invisibility. Baldness over the temples begins as the anterior hair line moves posteriorly. On the vertex scalp, miniaturisation progresses circumferentially to produce an expanding bald patch (see figure 6). On the frontal scalp, baldness begins at the anterior midline and moves laterally to create the so-called Christmas tree patterns (see figure 2).



**Figure 5.** In androgenetic alopecia, miniaturisation occurs initially in the secondary follicles. This leads to a reduction in hair density that precedes visible baldness. Bald scalp becomes visible only when all the hairs within a follicular unit are miniaturised. With miniaturisation, the muscle initially loses attachment to the secondary follicles. When primary follicles eventually miniaturise and lose muscle attachment, the hair loss becomes irreversible.



**Figure 6.** Stages of alopecia.

## Medical therapy

THE goal of medical therapy is to arrest progression and stimulate partial regrowth. Oral finasteride at a dose of 1mg daily will arrest progression in up to 95% of men and produce partial regrowth in up to 60%.<sup>14</sup> There are no significant drug interactions and the main toxicity relates to adverse sexual side effects. While generally reversible on discontinuation, there are reports of permanent sexual dysfunction. Higher doses

do not improve efficacy, but are associated with more frequent and severe adverse sexual side effects. Finasteride has a protective effect against future development of low-grade prostate cancer.<sup>15</sup>

Dutasteride is a more potent stimulator of hair regrowth than finasteride, but adverse sexual side effects are more common. Finasteride and dutasteride are potent teratogens with a long biological half-life and are contrain-

dicated in women of childbearing age.

Minoxidil can be used alone or in combination with finasteride. Minoxidil increases hair count, prolongs anagen duration and increases the linear growth rate of hair. Minoxidil is available both topically and orally. Known side effects of topical minoxidil include irritant and allergic contact dermatitis, hypertrichosis and a temporary telogen effluvium on

initiation of therapy. Known side effects of oral minoxidil include hypotension, fluid retention, tachycardia and hypertrichosis. These side effects are all dose-related and can be managed by dose titration. Hypertrichosis can be managed by depilatory creams, shaving, waxing, topical eflornithine or hair removal laser.

Spironolactone and cyproterone acetate are oral antiandrogens that arrest hair loss in over

90% of women, but only regrow hair in around 30% of women.<sup>16</sup> They are contraindicated in men because of sexual dysfunction.

Prostaglandin antagonists and prostanoids such as latanoprost, bimatoprost, setripitant and stemoxidine may also increase scalp hair density. The role of LED light, low level laser devices, and serial injection of platelet-rich plasma is still under investigation.<sup>17</sup>

## Hair replacement surgery

THERE are two main types of surgery. The first is hair transplantation, which is useful for people who wish to achieve a modest change in the fullness of their hair. The second involves scalp reduction procedures, which may produce more radical results.<sup>18</sup>

### Hair transplantation

Hair transplantation involves removing donor hair from the hair-bearing occipital scalp and relocating it to bald or thinning areas over the temples, frontal or vertex scalp. The size and shape of the grafts varies.

Round-shaped 'punch' grafts



**Figure 7.** Strip harvesting for follicular unit transplantation.

usually contain 10-25 hairs. Smaller 'mini' grafts contain 2-4 hairs. The 'micrograft' contains 1-2 hairs. The number of grafts required varies according to the severity of the baldness. For deep bitemporal recession, 500 grafts may suffice. A vertex bald spot may require 750 to 1000 grafts. Stage 5 hair loss baldness (see figure 3) may require 4000 grafts.

The two operations most commonly performed by hair transplantation surgeons are follicular unit transplantation and follicular unit extraction. 'Punch' grafts are occasionally used for the vertex of the scalp, however, these are rarely

favoured because of the unnatural doll's hair look they produce. They should never be used to recreate the anterior hairline. Punch grafts account for fewer than 1% of hair transplantation operations in Australia.

The hair that is transplanted will retain the same growth characteristics that it had in its original site. Therefore, if the donor site remains well-covered with hair, the recipient hair will continue to grow in the same way. If the donor site begins to bald, the same will happen to the recipient site. As the hair on the back and sides of the head continues to grow in advanced androgenetic

alopecia, these areas are chosen for donor sites. This hair is likely to continue growing for decades.

Good quality donor tissue may be hard to come by in people with poor donor populations and in people who have had multiple previous transplantations. If poor quality donor tissue is used, then balding may occur in the grafts.

Patients undergoing hair transplantation have an ongoing requirement for medical therapy to arrest further loss in the scalp adjacent to the recipient site and to avoid the need for future additional surgery. Without medical therapy, androgenetic alopecia is progressive and repeat operations will be required to compensate for ongoing loss. This was the norm prior to the introduction of finasteride 15 years ago. There is rarely sufficient donor hair population for more than three procedures. Since finasteride became widely available, fewer than 15% of patients require repeat hair transplantation surgery.

### Follicular unit transplantation

Strip harvesting is used to obtain donor tissue for follicular unit transplantation. Strip harvesting involves excision of a 10cm long strip of skin from the occipital scalp. Pre-operatively, the hair on the donor site is trimmed short to allow easy access (see figure 7). After the procedure patients are required to wear a pressure bandage for 24 hours to reduce bruising. The wound is closed primarily using a specialised trichophytic closure to conceal the scar. Follicles can also be transplanted into the scar to further disguise the scar. Scalp micropigmentation is another technique to conceal donor site scars (see figure 8).

Using a dissecting microscope, a team of 2-8 technicians then divides the harvested strip of scalp tissue into individual follicular units. This process may take up to eight hours, depending on the donor hair density in the strip and the number of technicians available. The follicular units are counted and sorted in 1-hair, 2-hair and 3-4-hair units for implantation. Individual follicular units are implanted one by one into very small surgical incision sites in the thinning or bald areas using either a needle or an implantation device.

In most men, a 1cm-wide strip harvested from the occipital scalp yields between 1000 and 2000 follicular units, depending on the donor hair density. Women tend to have a more diffuse pattern of hair loss and generally yield 750-1500.

The larger follicular units are used over the vertex scalp to recreate maximal hair density, while the single hair ones are used to recreate the anterior hairline. The surgeon takes great care when implanting the grafts to ensure they grow in the natural direction. Even the most experienced surgeons find that recreating a natural frontal anterior hairline is difficult and this is the most operator dependent part of the procedure. Choosing a surgeon carefully is, therefore, of paramount importance.

Two or three sessions, each 4-8 hours, may be required to achieve complete coverage in men with stage 5 androgenetic alopecia and these procedures may need to be



Figure 8. Before and after scalp micropigmentation.

spaced apart by several months to allow the scalp to recover before the next procedure (see figure 9).

Once the hair follicle has been inserted, it is normal for it to undergo a stress reaction where the hair follicle cycles and enters telogen. The telogen follicle sheds the hair fibres within a few weeks of the operation. After approximately three months of telogen where the follicle remains empty, the anagen phase of follicular growth commences and the hair fibre regrows at a rate of 1cm per month. As such, it takes 6-9 months before the patient can observe the full benefit of the transplantation. Occasionally, transplanted hairs do not survive and therefore do not produce hair fibres. This is uncommon with good operators.

Most patients are able to tolerate the entire hair transplantation procedure under local anaesthetic. A sedative may be used. Sedatives commonly produce temporary amnesia.

### Follicular unit extraction

Follicular unit extraction, or the Woods technique, is an alternate strategy to harvest donor tissue using multiple tiny punch biopsies. Each biopsy is around 0.75mm in diameter. Great care is required to angle the biopsy in line with the angle of the follicle to avoid transection. Each biopsy yields a single follicular unit. Multi-hair units are selected preferentially. The wound heals by contraction and secondary intention (see figure 10).

This is the procedure of choice for patients who have a buzz cut and will not tolerate an occipital scar. It has become increasingly popular over recent years and now accounts for around 40% of transplantation procedures performed in Australia.

The yield of donor follicular units is generally less than with follicular unit transplantation, with the latter the preferred procedure for women and men who wear their hair long at the back.

Overharvesting can be unsightly. Scalp micropigmentation is helpful in these cases.

### Scalp reduction surgery

Scalp reduction surgery involves removing the bald scalp and sewing it together end to end. The skin tends to stretch up to fill the defect left by the removed scalp and this can be used to rapidly decrease the size of the bald patch. It can be used as a stand-alone technique for small areas or complemented by hair transplantation for larger areas. The scalp will, of course, have a scar where the tissue reduction has



Figure 9a. Before hair transplantation.



Figure 9b. After hair transplantation.



Figure 10a. FUE donor site after harvesting 500 follicular units.



Figure 10b. FUE recipient site after placement of 250 follicular units.

been performed. This scar has the potential to become more noticeable as the balding progresses. Patients should keep this in mind when considering such treatment.

Scalp reduction surgery can be augmented with the use of tissue

expanders. The technique of tissue expansion has been developed to repair burns or other injuries that have led to large areas of skin loss. It can also be applied to disguise hair loss. The procedure involves a balloon-like device being inserted

beneath the hair-bearing areas of the scalp that lie next to bald areas. The device is then inflated with saline water over a period of weeks, which causes the skin to stretch and grow new skin cells. Eventually, a visible bulge will appear on the scalp. When enough skin is available, the surgeon will excise the bald spot and bring together the stretched skin with minimal tension.

### Pre-operative assessment and planning

The surgeon will give the patient specific advice on how to prepare for the operation. When it is safe to do so, aspirin should be ceased 10-14 days prior to surgery.

Patient need to be aware that the surgery is very noticeable for the first two weeks, and that all hair replacement techniques result in some scarring. Patients will require a full day off work for the surgery. Most people prefer to take a week off after the surgery to allow for healing of the implants and for the bruising to reduce before they return to work. Scarring is usually hidden by the growing hair. There are many horror stories on the internet and in popular culture about problems with hair transplantation. Most of these relate to the earlier techniques of 'punch' grafting, which is not aesthetically acceptable by today's standards. Newer techniques using 'mini' grafts, 'micro' grafts and follicular unit transplants yield much better cosmetic results.

### Post-operative care

#### Immediate post-operative care

Saline with ATP is sprayed onto the grafts for two days, then antiseptic shampoo for a week, then back to normal shampoo and activity. Contact sports may be resumed after one month. Complications are rare. Minor shock loss from the surgery at two weeks and a few pimples (folliculitis) may form as the hairs begin to grow out at two months. Both of these complications usually resolve but may present to the GP as a patient concern. Diminished growth may also present. Refer these patients to their treating specialist for management.

#### Long-term care

Treat the new growth exactly the same as non-transplanted hair, no special care is needed. However non-transplanted hair can recede from these grafts if stabilising medication is not taken.

### Transplantation for eyebrows

There are many eyebrow shapes and styles. Eyebrows have much more variation than scalp hairlines. Male eyebrows sit at the orbital rim but female eyebrows often rise above the rim, some with a high arch and others flat. There is usually some hair left in the eyebrows to guide surgeons in setting out the area for graft implantation. The surgeon first needs to define the medial starting point, the location of the arch and the lateral ending point. There is a herringbone pattern of growth, with the lower hairs growing upwards and the upper hairs growing downwards.

Eyebrow loss can be secondary to trichotillomania, alopecia areata,

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frontal fibrosing alopecia, hypothyroidism or simply chronological ageing. It is prudent to establish the cause of eyebrow loss prior to transplantation and ensure the condition is in remission, otherwise the new hairs will be in danger of being lost.

Hair transplants can replicate the natural growth and direction of eyebrow hairs. However, there is no donor hair population that has the exact same growth characteristics as eyebrow hair. Hair from the scalp behind the ears is closest in terms of fibre diameter, but it has a longer anagen duration, that is, it continues growing and requires regular trimming. Hair follicle donor grafts are prepared in the same way as for scalp transplantation, except that the hairs are trimmed no shorter than one centimetre long to show the direction of the curl of the hair. They are implanted as flat as possible because the healing process raises their exit angle of growth. At the time of implantation, it is very important to orientate the grafts with the curl towards the skin. Incorrectly orientated hairs end up growing outwards with the curl away from the skin. Electrolysis is the best way to manage these errant hairs.

A well-transplanted eyebrow gives much pleasure, but a poor result is a disaster as it is very visible. For this reason, many patients lean towards tattooing the eyebrows as a more predictable technique for managing eyebrow hair loss (see figure 11).

### Transplantation for cicatricial alopecia

This is a contentious area with wide differences of opinions among practitioners. The discord revolves around the susceptibility of the transplanted hairs to the underlying condition that caused the cicatricial alopecia. Most surgeons will only operate when there has been no progression of the cicatricial alopecia for at least two years.<sup>19</sup>

High-quality serial scalp photography is required to be certain the scalp inflammation is in remission. The classification of primary inflammatory cicatricial alopecia is complex, the natural history variable and the management often unsatisfactory. Lupus, lichen planopilaris, frontal fibrosing alopecia and folliculitis decalvans are the most common causes of primary cicatricial alopecia. Multidisciplinary care involving dermatologists and hair transplantation surgeons is required to determine the opti-



Figure 11. Micropigmentation of the eyebrow. A. Before B. After the first session and C. After the second session.



Figure 12. Scalp reduction surgery for frontal fibrosing alopecia. A thin strip of forehead skin is excised. An advancement flap is used to move the hair line anteriorly and the wound is sutured.

mal timing of the procedure.

Procedures for secondary cicatricial alopecia due to accidents, burns, facelift, radiation-induced hair loss and pressure alopecia can proceed immediately. Those for traction alopecia and trichotillomania can proceed once the traction and pulling has stopped.

Scalp mobility is variable. In some patients with highly mobile scalp, large patches of cicatricial alopecia may be amenable to surgical excision. Serial excision may be used when there is less scalp mobility. Hair follicle transplantation into the resulting scar and any smaller areas can be performed as a subsequent procedure.

Follicle transplantation is used for patients with minimal scalp mobility. Two to three sittings may be required for extensive areas of alopecia. The vascularity in the patches of cicatricial alopecia is often less than in normal scalp. As a result, less adrenaline is required for vasoconstriction and implants need to be spaced further apart than in a normal scalp. With these

two adjustments, growth is usually satisfactory. Scalp micropigmentation (fine tattoo) can be used as an adjuvant procedure to create the appearance of increased density.

Scalp expansion will be necessary when the loss of hair approaches 50%. When hair loss exceeds 50%, a well-made hairpiece may be the best option for the patient.

### Scalp reduction for frontal fibrosing alopecia

Professor Steven Kossard first described frontal fibrosing alopecia in 1994.<sup>20</sup> While once rare, this condition is now the most common cause of cicatricial alopecia worldwide.<sup>21</sup> The increasing prevalence has been attributed to the daily application of sunscreens to the forehead.<sup>22</sup> Women over 50 are most commonly affected and these women have often been applying moisturisers and day creams containing sunscreen to their face every day summer and winter for decades.

Frontal fibrosing alopecia is a lymphocyte mediated scarring alopecia that destroys follicles in the

hairline, behind the ears and in the nape of the neck. Typically the eyebrows are lost first and some months to years later the hairline recedes. Medical treatment can be used to stabilise the hair loss. However, the hair that is lost cannot be retrieved so surgical correction is the only way to restore hair.

If excision of the alopecia and primary closure is possible, scalp reduction surgery provides an instant fix. With some preparation to loosen the scalp, an advancement of 2-3cm is possible (see figure 12). The lowered hairline changes the facial appearance dramatically. Transplantation is an alternative to scalp reduction surgery for frontal fibrosing alopecia, but takes much more time to produce this effect and is more costly. The success of both surgical treatments relies on ongoing medical therapy to maintain remission of the frontal fibrosing alopecia process. If medications are stopped, it can recur and damage the new anterior hairline. This, in turn, will expose the scalp reduction surgery scar.

### Online resources

Better Health Channel  
Hair  
<http://bit.ly/2ncXwTi>

Hair transplant surgery  
<http://bit.ly/2oKJENf>

Patterned hair loss  
<http://bit.ly/2p33cvx>

The Conversation  
Health Check: why does women's hair thin out?  
<http://bit.ly/2p2NHDZ>

Starting to thin out? Hair loss doesn't have to lead to baldness  
<http://bit.ly/2obWB4W>

Australia | International Society of Hair Restoration Surgery  
<http://bit.ly/2tC9cBa>

Biofibre artificial Hair – Medicap  
<http://bit.ly/2o4RfOW>

### References

Available on request from  
[howtotreat@adg.com.au](mailto:howtotreat@adg.com.au)

## The future

### Hair cloning

THE ultimate goal of hair cloning is to excise a single follicle in a punch biopsy, isolate the dermal papilla cells from that single hair follicle, expand the cell population in culture and then re-implant multiple cultured dermal papilla into the skin. Each papilla would then induce differentiation of the overlying epidermis into multiple terminal hair-producing scalp follicles.

Presently, isolated dermal papilla

aggregates can be implanted into human skin and induce hair follicle formation. The major limiting step occurs when the dermal papilla aggregates are cultured in vitro, where they initially disaggregate and form a monolayer on the surface of the culture medium. Cells in a monolayer are unable to induce hair follicle neogenesis when implanted into human skin. After a few days in the culture the dermal papilla cells spontaneously

reform an aggregate that is capable of inducing hair follicle neogenesis. At this stage, however, there has been no cell division or expansion of dermal papilla cell numbers.

If left longer in a culture medium the cells again disaggregate into a monolayer and the dermal papilla cells start to proliferate. A 100,000-fold expansion in cell numbers can occur before cells senesce. Unfortunately, cell expansion occurs with the loss of hair follicle induc-

tive capacity and there is no further spontaneous cell aggregation. There has recently been some progress in this regard, however, further work is required before human trials can commence.

### Artificial fibres

Artificial biofibres are an attractive concept for hair replacement. The results are instantaneous and patient satisfaction is very high initially. The limitation is that these

fibres do not regrow once cut or change colour as the patient goes grey. The fibres generally only last 5-10 years. In the author's experience, around 5-15% of patients develop a foreign body reaction that requires removal of the fibres. Regular maintenance is required to extract comedos that build up where the fibre exits the skin. Further work is required to produce less reactive fibres.

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## Case study

GEORGE is a 48-year-old recent divorcee. He had been aware of progressive hair loss over a number of years. He initially trialed topical minoxidil, but found that eight months of therapy produced no visible increase in hair density and so discontinued therapy. He subsequently consulted his GP about his hair loss and was prescribed finasteride 1mg daily. He was intolerant of this treatment because of loss of libido and erectile dysfunction. Libido and sexual function returned to normal two months after discontinuing the treatment.

He was referred to a dermatologist who prescribed oral minoxidil 0.5mg daily. His hair loss was arrested and over 12 months there was partial regrowth of his vertex and frontal hair.

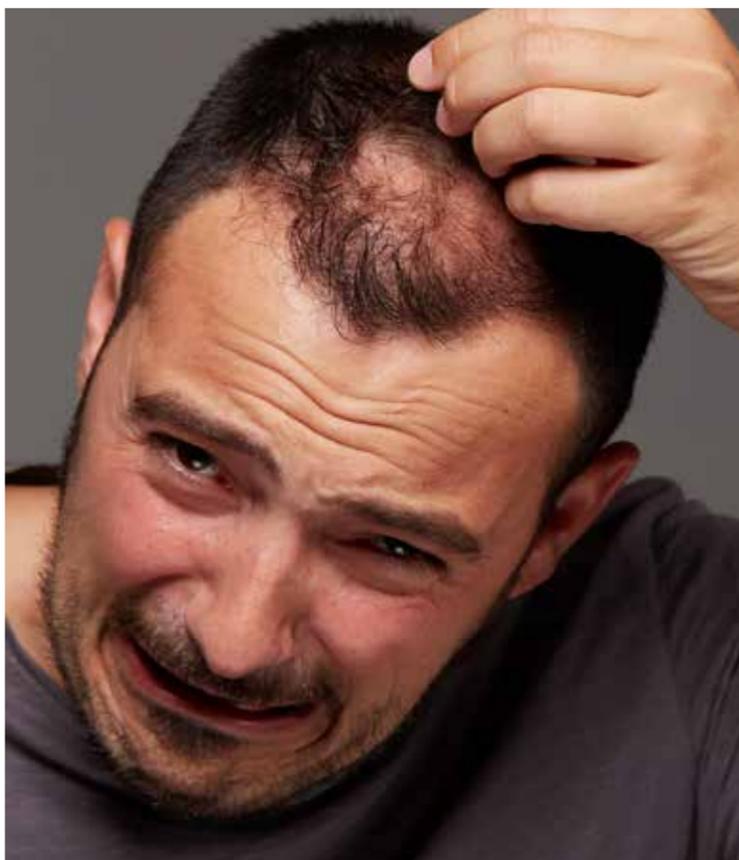
George then consulted a hair transplant surgeon who assessed him as a suitable candidate for hair transplantation. After considering the surgical options, he elected to have the follicular unit extraction procedure as a day

procedure under local anaesthetic without sedation. One thousand 0.75mm donor grafts were removed from his occipital scalp and the wound left to heal by secondary intention.

The grafts were inspected for transection, further microdissected into follicular units and each graft was then individually implanted into an incision made with a 19 or 20 gauge needle. The scalp was cleaned and dressed and George was discharged home after six hours.

He was able to wash his hair after 24 hours. At one week, the recipient site wounds had healed and at two weeks, the donor site wounds had healed and were concealed by hair regrowth.

At three months, new hairs began to emerge from the implanted follicles. At 12 months, the scalp coverage was complete. George continued to take oral minoxidil and was advised the medical therapy should be continued long-term to maintain hair density.

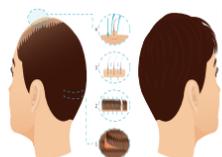


## Conclusion

THE vast majority of patients affected by patterned hair loss can be effectively treated with a combination of medical, surgical and camouflage techniques. Patients who start treatment early do better and may manage with medical therapy alone. Patients with advanced hair loss should only be considered for hair restoration surgery after having been on medical therapy for 6-12 months. This is to stabilise the hair loss and improve donor site hair density. As patterned hair loss is a progressive condition when untreated, medical therapy should be continued long term after hair restoration surgery to prevent balding in the hairs adjacent to the implants.

### Conflict of interest statement

Professor Sinclair is a dermatologist. Dr Marzola is a hair transplant surgeon.



## How to Treat Quiz

Hair restoration — 4 August 2017

GO ONLINE TO COMPLETE THE QUIZ

[www.australiandoctor.com.au/education/how-to-treat](http://www.australiandoctor.com.au/education/how-to-treat)

### 1. Which TWO statements regarding the background to hair restoration are correct?

- a) The principle of donor dominance states that the behaviour of transplanted hairs is determined by the characteristics of the donor site rather than the recipient site.
- b) The field of hair transplantation has not seen any major advances in the past 15 years.
- c) Men and women with advanced androgenetic alopecia can be managed effectively with a combination of medical therapy and hair transplantation surgery.
- d) Follicular unit transplantation accounts for over 95% of transplants in men.

### 2. Which THREE statements regarding patterned hair loss are correct?

- a) The pattern of hair loss in men (male pattern hair loss) and women (female pattern hair loss) are relatively constant.
- b) In Australia there are estimated to be about four million balding men.
- c) Premature hair loss is defined as hair loss that exceeds normal age-related androgenetic alopecia.
- d) Premature hair loss may diminish physical attractiveness.

### 3. Which TWO statements regarding patterned hair loss are correct?

- a) Premature androgenetic alopecia has a monogenetic aetiology.
- b) Epigenetic silencing of the androgen receptor gene on the occipital scalp protects these follicles from the balding process.
- c) The initial loss in androgenetic alopecia is

due to miniaturisation of secondary follicles over the frontal and vertex scalp.

- d) Body hairs are tufted and arise from complex pilo-sebaceous units comprising one primary hair, up to five secondary hairs that bud off the side wall of the primary follicle, a single sebaceous gland and a single arrector pili muscle.

### 4. Which THREE statements regarding the patterns of baldness are correct?

- a) Baldness occurs when all the hairs within a complex pilo-sebaceous unit have miniaturised to the point of invisibility.
- b) Baldness over the temples begins at the anterior hairline and moves posteriorly.
- c) On the vertex scalp, miniaturisation progresses circumferentially to produce an expanding bald patch.
- d) On the vertex scalp, baldness begins at the anterior midline and moves laterally to create the so-called Christmas tree pattern.

### 5. Which TWO statements regarding medical therapy are correct?

- a) The goal of medical therapy is to restore a full head of hair identical to that prior to the hair loss.
- b) Known side effects of topical minoxidil include irritant and allergic contact dermatitis, hypertrichosis and a temporary telogen effluvium on initiation of therapy.
- c) Finasteride and dutasteride are safe in women of child-bearing age.
- d) Spironolactone and cyproterone acetate are contraindicated in men because of

sexual dysfunction.

### 6. Which THREE are features of oral finasteride?

- a) There are no significant drug interactions and the main toxicity relates to adverse sexual side effects.
- b) The sexual side effects are always reversible on discontinuation of the drug.
- c) Higher doses do not improve efficacy, but are associated with more frequent and severe adverse sexual side effects.
- d) Finasteride has a protective effect against future development of low-grade prostate cancer.

### 7. Which TWO of the following may also increase scalp hair density?

- a) Prostaglandin antagonists.
- b) Serial injection of platelet-rich plasma.
- c) Low-level laser devices.
- d) Prostanoids.

### 8. Which THREE statements regarding hair replacement surgery are correct?

- a) Scalp reduction procedures are useful for people who wish to achieve a modest change in the fullness of their hair.
- b) Hair transplantation involves removing donor hair from the hair-bearing occipital scalp and relocating it to bald or thinning areas over the temples, frontal or vertex scalp.
- c) High-quality donor tissue may be hard to come by in people with poor donor populations and in people who have had multiple previous transplantations.

- d) Without medical therapy, androgenetic alopecia is progressive and repeat operations will be required to compensate for ongoing loss.

### 9. Which TWO statements regarding hair replacement surgery are correct?

- a) Strip harvesting is used to obtain donor tissue for follicular unit transplantation.
- b) Once the hair follicle has been inserted, it is normal for it to shed the hair fibres within a few weeks of the operation.
- c) Follicular unit extraction is the preferred procedure for women and men who wear their hair long at the back.
- d) It takes three months after follicular unit transplantation before the patient can observe the full benefit of the transplantation.

### 10. Which THREE statements regarding hair replacement surgery are correct?

- a) Lupus, lichen planopilaris, frontal fibrosing alopecia and folliculitis decalvans are the most common causes of primary cicatricial alopecia.
- b) It is prudent to establish the cause of eyebrow loss prior to transplantation and ensure the condition is in remission, otherwise the new hairs will be in danger of being lost.
- c) Frontal fibrosing alopecia is most commonly seen in women over 50.
- d) Eyebrow hair grows in a 'fern pattern', with all hairs growing upwards, making transplants easy and quick to perform.

## CPD POINTS

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Each How to Treat has been allocated 2 RACGP QI&CPD points and 1 ACRRM point. RACGP points are uploaded every six weeks and ACRRM PD points are uploaded quarterly.

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## NEXT WEEK'S HOW TO TREAT



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