

# Efficacy of Finasteride Treatment Versus Low-Level Laser in Frontal Male and Female Pattern Hair Loss

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## ABSTRACT

*This study has been conducted to determine effect of finasteride treatment (FST) versus low level laser (LLL) in frontal male and female pattern hair loss. Data were collected from forty patients, ranging in age from 35 to 50 years ( $42.25 \pm 1.85$ ), selected from outpatient clinic of the dermatology department at Ain Shams University hospitals. They were divided randomly into two groups of equal number and received 1mg oral finasteride per day for 3 months in the first group and low level laser via the hairmax comb one time daily (15 minutes/ session) for 3 months in the second group. Photographic assessment via the 7-point assessment scale (7-PAS) and the hair counting measurement (HCM) were carried out before and after the end of the treatment program (3 months). Data collected at the end of the treatment program showed that averages of the 7-PAS were  $0.2960 \pm 1.1041$  and  $0.2961 \pm 1.1279$  degrees in the finasteride and laser groups respectively, while averages of HCM were  $26.0101 \pm 8.1763$  and  $26.0112 \pm 8.1664$  hairs in the finasteride and laser groups respectively. At the end of the treatment program results showed a highly significant increase in the 7-PAS and HCM at the end of the treatment program in both groups. So both finasteride treatment (FST) and low level laser (LLL) were effective and nearly equivalent in improving hair regrowth in frontal male and female pattern hair loss as manifested by the increased 7-PAS and HCM.*

## INTRODUCTION

**F**emale pattern hair loss (FPHL), is the most common form of hair loss, affects up to 50% of women during their life. Although hair thinning in women with FPHL may be diffuse, 3 different clinical patterns have been described; the Christmas tree pattern, the Ludwig pattern and the Hamilton pattern. Patients who experience hair thinning complain of social anxiety and embarrassment. If left untreated, FPHL may be rapidly progressive<sup>2,11,14</sup>.

Treatment for FPHL consists mainly of topical minoxidil which is vasodilator and antihypertensive drug. 5% minoxidil and oral finasteride are the revolutionary ingredients that widely discussed in the media as products that revitalizes hair. Dermatologic research in many countries has shown that minoxidil acts on the hair follicles to stimulate hair growth and delay hair loss. Minoxidil and finasteride inhibit miniaturization of the affected hair follicles and decrease level of the dihydrotestosterone (DHT) serum, so they are applied in the baldness pattern for men and women as well as male androgenic alopecia, but sometimes minoxidil is not well accepted by the patient<sup>2,7,13</sup>.

Male pattern hair loss (MPHL), or androgenetic alopecia, is a common condition with both genetic and hormonal origins. Typically, there is progressive loss and thinning of hair in an easily recognizable pattern of bitemporal and anterior/mid scalp recession or vertex thinning. Although the rate of hair loss varies in individual men, the cyclical process is slow, such that over several years, terminal hairs are gradually replaced by progressively finer and less pigmented miniaturized hairs<sup>7,12</sup>.

Although the genetic component is still being elucidated, the essential involvement of androgens has been known for more than 50 years. It is now clear that DHT rather than testosterone is the principal androgen responsible for male pattern hair loss. This was confirmed by the observation that men with inherited type II 5 $\alpha$ -reductase deficiency have low levels of DHT and normal to high levels of testosterone, but do not experience male pattern hair loss. Furthermore, it has been shown that baseline DHT levels are higher in balding scalp versus hairy scalp<sup>1,11,13</sup>.

Finasteride, a specific inhibitor of the human type II 5 $\alpha$ -reductase enzyme, has been shown to reduce both serum and scalp skin

DHT levels in balding men. Finasteride works by blocking the enzyme 5 alpha-reductase and reduces the DHT hormone levels in the scalp allowing hairs to revert to a normal growth cycle. Recent data have also demonstrated that finasteride 1mg /day increases scalp hair in men with vertex thinning<sup>3,5,14</sup>.

Low intensity laser light therapy has been shown to be effective in promoting wound healing and improving circulation. For this reason, some hair loss treatment centers are offering the use of lasers for treating alopecia in both women and men<sup>10,18</sup>. The use of low levels of visible or near infrared light for reducing pain, inflammation and oedema, promoting healing of wounds, deeper tissue and nerves, and preventing tissue damage has been known for almost 40 years since the invention of lasers. The HairMax Laser Comb® is a hand-held class 3R lower level laser therapy device that contains a single laser module that emulates 9 beams at a wavelength of 655nm (+/-5%)<sup>10,16</sup>.

The HairMax Laser Comb® uses a technique of parting the user's hair by combs that are attached to the device. This improves delivery of distributed laser light to the scalp. The combs are designed so that each of the teeth on the combs aligns with a laser beam. By aligning the teeth with the laser beams, the hair can be parted and the laser energy delivered to the scalp of the user without obstruction by the individual hairs on the scalp<sup>1,11,13</sup>.

Even though there are more than 2500 papers related to LLLT in the scientific literature, only one printed reference, Professor Pekka Pontinen's text, was found which actually discussed the use of LLLT "to stimulate hair growth". Even in this source, the information was limited to one paragraph, which refers to one paper given in Sorrento in 1982 which reported increased hair growth after LLLT in animals, and another publication in 1983 which reported favorable results with LLLT in the treatment of alopecia areata. The authors heard about Dr. Martin Unger's paper "Low level laser therapy for hair biostimulation" in the 9<sup>th</sup> Annual Meeting of the International Society of Hair Restoration Surgery, Puerto Vallarta, Mexico, and around

this same time period, the fall of 2001, became interested in the HairMax Laser Comb<sup>15,17</sup>.

## MATERIAL AND METHODS

### Subjects

Forty patients (22 females and 18 males) suffering from frontal pattern hair loss, ranging in age from 35 to 50 years ( $42.25 \pm 1.85$ ), and selected from the outpatient clinic of dermatology department at Ain Shams University hospitals, patients were not familiar with the finasteride treatment (FST) and the technique of low level laser (LLL) and they were divided equally in number into two groups. They were consented to receive FST for the first group and low level laser (LLL) for the second group. All patients were carefully assessed by dermatologist and received the same and necessary physiotherapeutical regimen (massaging the treated area of pattern hair loss for about 5 minutes), drugs, medical and nursing care<sup>4,3,8</sup>.

### Instrumentation and tools:

#### 1- Prohair Tablets (Finasteride) 1mg:

One tablet orally per day for 3 months, finasteride 1mg works by blocking the enzyme 5-alpha reductase and this reduce level of the DHT hormone in the scalp allowing hairs to revert to a normal growth cycle<sup>10,18</sup>.

#### 2- Hairmax laser comb:

The HairMax Laser Comb® is a hand-held class 3R lower level laser therapy device that contains a single laser module that emulates 9 beams at a wavelength of 655nm (+/-5%), Power of 4.5mw with a Continuous wave<sup>15,16</sup>.

### Procedures

#### Evaluation:

A- Global photographs via the 7- point assessment scale: Global photographs for each patient were taken before treatment application and 3 months after treatment application. Three expert investigators independently evaluated the global photographs for each time point compared with the baseline global photograph. These global photographs were assessed versus the baseline global photographs using the same 7- point assessment scale. Photograph follow up using

digital camera (Sony cyber-shot with 4x optical zoom and 7mega pixels). Investigator assessment of hair growth will be done via assessing each patient by means of a standardized 7-point rating scale to answer the following questions: "As the investigator, how would you subjectively rate the patient's hair at this time point compared to baseline?" The options for the investigator will be as follows: -3= greatly decreased, -2= moderately decreased, -1= slightly decreased, 0= no change, 1= slightly increased, 2= moderately increased and 3= greatly increased<sup>9,18</sup>.

**B- Hair counting:** Hair count was measured in a 1-inch-diameter determined circular area centered at the leading edge of the area of thinning frontal scalp hair. Hair-count data were obtained from macrophotographs of the area by converting all visible hairs in the macrophotographs to dot maps. The hairs in the dot map were counted using computer-assisted image analysis, which detected only "non-vellus-like/miniaturized" hairs. Thus, hair counts measured only "cosmetically significant" hairs. Hair counts were assessed by the difference between the count at each time point versus the baseline count, and the mean hair count values for each treatment group were determined using Least Squares Means<sup>2,5,11</sup>.

#### **Treatment:**

Patients of the first study group were orally administered finasteride 1mg daily for 3 months, while patients of the second study group and according to the aforementioned stimulation parameters and principal characteristics of the hairmax comb laser a technique of parting the user's hair by combs that are attached to the device to improves delivery of distributed laser light to the scalp was used. The combs are designed so that each of the teeth on the combs aligns with a laser beam. By aligning the teeth with the laser beams, the hair can be parted and the laser energy delivered to the scalp of the user without obstruction by the individual hairs on the scalp<sup>1,11,13</sup>.

Patient's eyes were protected from the laser irradiation and every patient was placed in suitable comfort sitting position. Before

beginning of the treatment, the laser device was checked to be sure that, it is switched off, application of the low level laser hair comb on the scalp after cleaning of the scalp with alcohol to remove any oil or cream. After drying hair, massaging the treated area for about 5 minutes and then turn on laser comb then place laser device flat on the scalp. Move laser comb slowly using glide method by placing the laser comb on a spot and leaving it there for 4 seconds then moving it 1/2 inch to the next spot, move laser device from front to back then from bottom to top. Total time of application was 15 minutes daily for 3 months<sup>8,10,18</sup>.

#### **Data Analysis**

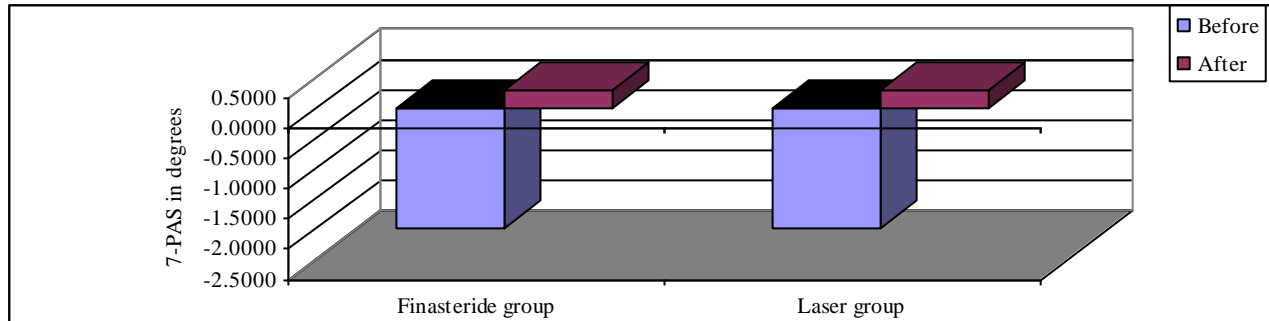
7-PAS and HCMN records were measured before treatment and after cessation of the treatment program in both groups. Collected data were fed into computer for the statistical analysis; descriptive statistics as mean, standard deviation, minimum and maximum were calculated for each group. The t-test was done to compare the mean difference of the two groups before and after application and within each group. Alpha point of 0.05 was used as a level of significance<sup>6,11,17</sup>.

### **RESULTS**

In the present study, the effect of FST and LLL on 7-PAS and HCM in frontal male and female pattern hair loss was investigated. As shown in table (1) and figure (1), the mean value of the 7-PAS before treatment was  $(-2.0100 \pm 0.334)$  degrees in the first group (finasteride group), while after treatment was  $(0.2960 \pm 1.1041)$  degrees. These results revealed a highly significant increase in the 7-PAS, ( $P < 0.0001$ ), but in the second group (laser group), the mean value of the 7-PAS, before treatment was  $(-2.0101 \pm 0.372)$  degrees, while after treatment was  $(0.2961 \pm 1.1279)$  degrees, and these revealed also highly significant increase in the 7-PAS, ( $P < 0.0001$ ).

**Table (1): Comparison of the mean values of the 7-PAS, before and after treatment in both groups.**

	Before treatment		After treatment		P. value
	X	SD	X	SD	
First Group	-2.0100	0.334	0.2960	1.1041	<0.0001
Second Group	-2.0101	0.372	0.2961	1.1279	<0.0001

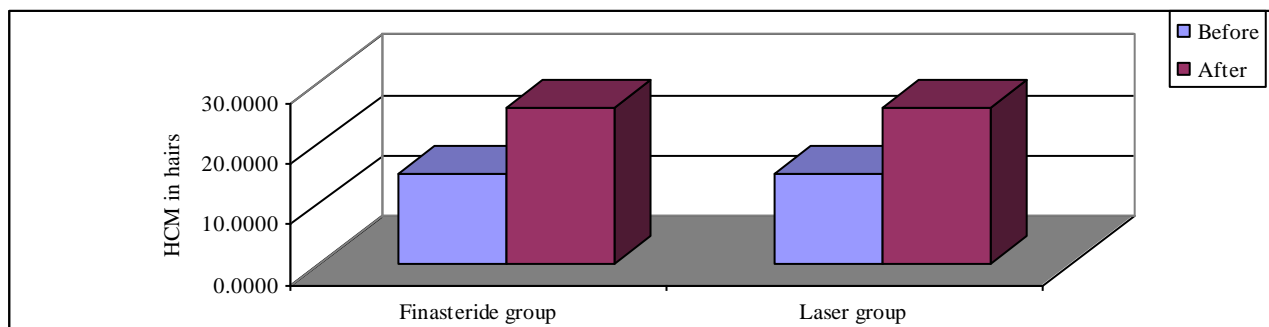
**Fig. (1): Mean values of the 7-PAS before and after treatment in both groups.**

Also as shown in table (2) and figure (2), the mean value of HCM scores, before treatment was  $15.0771 \pm 5.8442$  hairs in the first group (finasteride group), while after treatment was  $26.0101 \pm 8.1763$  hairs. These results revealed a highly significant increase in HCM scores, ( $P < 0.0001$ ). But in the second

group (laser group), the mean value of the HCM scores, before treatment was  $15.0122 \pm 5.8341$  hairs, while after treatment was  $26.0112 \pm 8.1664$  hairs, and these revealed also highly significant increase in HCM scores, ( $P < 0.0001$ ).

**Table (2): Comparison of the mean values of the HCM scores before and after treatment in both groups.**

	Before treatment		After treatment		P. value
	X	SD	X	SD	
First Group	15.077	5.844	26.010	8.1763	<0.0001
Second Group	15.012	5.834	26.011	8.1664	<0.0001

**Fig. (2): Mean values of HCM scores before and after treatment in both groups.**

## DISCUSSION

Normal development and cycling of hair follicles depend on the interaction of the follicular epithelium with the adjacent mesenchymal dermal papilla. The dermal

papilla induces hair-follicle formation from the overlying epithelium during fetal development, and at the onset of each new follicular cycle in adults the dermal papilla interacts with secondary germ cells in the hair-follicle bulge to regenerate the lower follicle.

The bulge consists of a cluster of biochemically distinct cells in the outer-root sheath, which is located near the insertion of the arrector pili muscle. These cells have the characteristic properties of epithelial stem cells: they are the slowest-cycling and longest-lived epithelial cells within the hair follicle<sup>2,7,10,15</sup>.

Epithelial stem cells in the bulge portion of the outer-root sheath may also as a reservoir for epidermal and sebaceous-gland cells. Cells in the outer-root sheath normally express an array of keratins, adhesion molecules, cytokines, and growth factor receptors that are distinct from those expressed by epidermal cells. They hyperproliferative states such as psoriasis and during wound healing, epidermal cells produce keratins and which are normally found only in the outer-root sheath of hair follicles and that is a further evidence of the close relation between the epidermis and the hair follicle<sup>7,12,13,14</sup>.

Hair follicles vary considerably in size and shape, depending on their location, but they all have the same basic structure. Rapidly proliferating matrix cells in the hair bulb produce the hair shaft, whose bulk the cortex is composed of hair-specific intermediate filaments and associated proteins. Pigment in the hair shaft is produced by melanocytes interspersed among the matrix cells. As the matrix cells differentiate and move upward, they are compressed and funneled into their final shape by the rigid inner-root sheath, whose dimensions and curvature largely determine the shape of the hair. The dermal papilla, which is composed of specialized fibroblasts located at the base of the follicle, is thought to control the number of matrix cells and thus the size of hair<sup>12,13,16</sup>.

Hair follicles in balding skin differ from those in nonbalding skin with respect to the metabolism of androgen, the numbers of androgen receptors in the dermal papilla, and the secretory responses of the cells in the dermal papilla. Some dermal papillae secrete mitogens after androgenic stimulation, thus increasing hair growth, whereas others synthesize inhibitory factors, thus reducing hair growth. These paradoxical effects of androgens on hair growth may be explained by

genetically determined differences in the end-organ response of individual hair follicles<sup>2,13,14</sup>.

Low-level laser therapy (LLLT) is a new therapy for the treatment of hair loss. Recently a great deal of men and women suffer from quantitative and qualitative disorders of hair growth of diverse etiology. Based on the property of low intensive laser radiation to activate substantially the microcirculation, enhances metabolic and regulate neurohumoral processes, normalizes by means of laser the functioning of hair follicle and reduce degeneration-dystrophic processes in derma which result in disorder of hair regeneration<sup>4,8,16</sup>.

The findings of the present study showed non significant difference in the pre-treatment records of the 7-PAS, between the first and second groups, as well as in the pre-treatment records of the HCM, between the mean values of both groups.

Results of this study revealed a highly significant increase in the mean values of the 7-PAS and HCM of the first group after the administration of finasteride, where 7-PAS (2) compared with the mean value of 7-PAS (1) as well as HCM (2) compared with the mean value of HCM (1).

Also results of this study revealed also a highly significant increase in the mean values of 7-PAS and HCM of the second group after the application of the low level laser, where 7-PAS (2) compared with the mean value of 7-PAS (1) as well as HCM (2) compared with the mean value of HCM (1).

Comparing mean values of the post-treatment records of both 7-PAS and HCM in the first group with the mean values of the post-treatment records of both 7-PAS and HCM in the second group revealed non significant difference ( $P > 0.05$ ), indicating an equivalent effects for the finasteride administration and the low level laser application.

Significant differences showed in this study, were consistent with those observed and recorded by Agaiby et al., 2000<sup>2</sup>; Blahnik and Rindge, 2003<sup>10</sup>; Botchkarev et al., 1997<sup>12</sup>; Apricot et al., 2000<sup>4</sup>; Trelles and Mayayo, 1982<sup>18</sup>; Branco, 2005<sup>13</sup>; Apple et al., 2004<sup>3</sup>; Bisht et al., 2002<sup>8</sup>; Bjordal et al., 1998<sup>9</sup> and Chow, 1994<sup>17</sup>.

Results of this study supports the expectation that both finasteride treatment and low level laser application were significantly effective in improving hair regrowth and decreasing hair loss as manifested by the increased 7-PAS and HCM.

### Conclusion

The novel use of the equivalent effects of both finasteride treatment and low level laser application may be a promising new option for the treatment of the frontal male and female pattern hair loss. Further follow-up and larger studies will determine the durability and repeatability of the responses we have observed.

### REFERENCES

- 1- Abraham, M.K.: Scalp anatomy, Journal of medicine specialties otolaryngology and facial Pastic surgery, 2006.
- 2- Agaiby, A.D., Ghali, L.R. and Wilson, R.N.: Laser modulation of angiogenic factor production by T-lymphocytes. *Lasers Surg Med*, 26: 357-363, 2000.
- 3- Appel, E.A., Shainberg, A.A. and Schwartz, F.H.: Finasteride treatment of pattern hair loss in post-menopausal women. *Dermatology*; 209: 202-207, 2004.
- 4- Apricot, V.H., Roberts, J.L. and Olsen, E.A.: Lack of efficacy of finasteride in postmenopausal women with androgenetic alopecia. *J Am Acad Dermatol*; 43(5pt1): 768-776, 2000.
- 5- Asada, K.A., Yutani, Y.R. and Shimazu, A.P.: Clinical application of Ga-Al-As 830 nm diode laser in treatment of rheumatoid arthritis. *Laser Therapy*; 3: 77-82, 1991.
- 6- Balaban, P.P., Letokhov, V.A. and Kutomkina, E.L.: He-Ne laser irradiation of single identified neurons. *Lasers Surg Med*, 12: 329-337, 1992.
- 7- Baxter, G.D.: *Therapeutic Lasers: Theory and Practice*. London, England: Churchill Livingstone; 27-41, 1994.
- 8- Bisht, D.S., Gupta, S.C. and Misra, V.P.: Effect of low intensity laser radiation and finasteride treatment on female androgenic alopecia. *Br J Dermatol*. 147: 812-813, 2002.
- 9- Bjordal, J.M., Couppe, C.R. and Ljunggren, E.A.: Finasteride in the treatment of men with androgenetic alopecia. *J Am Acad Dermatol*; 39: 578-588, 1998.
- 10- Blahnik, J.A. and Rindge, D.W.: *Laser Therapy: A Clinical Manual*. Melbourne, FL: Healing Light Seminars Inc, 2003.
- 11- Botchkarev, V.A., Chen, L.H. and Albers, K.M.: A role for p75 neurotrophins receptor in the control of apoptosis-driven hair follicle regression. *Faseb J*, 14: 1931-1942, 2000.
- 12- Botchkarev, V.A., Eichmullers, J.H. and Johansson, O.P.: Hair cycle dependent plasticity of skin and innervation in normal murine skin. *J Comp Neurol*; 386: 379-395, 1997.
- 13- Branco, K.J.: Treatment of female pattern hair loss with oral finasteride. *Br J Dermatol*; 152: 466-473, 2005.
- 14- Byrnes, K.R., Barna, L.K. and Longo, L.F.: Photobiomodulation improves cutaneous wound healing in an animal model of type II diabetes. *Photomed Laser Surg*, 22: 281-290, 2004.
- 15- Byrnes, K.R., Waynant, R.W. and Smith, K.J.: Light promotes regeneration and functional recovery and alters the immune response after spinal cord injury. *Lasers Surg Med*, 36: 171-185, 2005.
- 16- Chen, Y.S., Hsu, S.F. and Chiu, C.W.: Effect of low-power pulsed laser on peripheral nerve regeneration in rats. *Microsurgery*, 25: 83-89, 2005.
- 17- Chow, R.T.: Results of Australia-wide survey into Laser use. *The Journal of the Australian Medical Acupuncture Society*, 12(2): 28-32, 1994.
- 18- Trelles, M.A. and Mayayo, E.S.: The growth of hair under influence of the He-Ne laser beam: Histological study. Sorrento. World Congress of Laser-Therapy, 1982.

### الملخص العربي

#### فاعلية العلاج بالفينايستيرايد مقابل الليزر منخفض الشدة على نمط سقوط الشعر الأمامي لدى الذكور و الإناث

أجريت هذه الدراسة لتحديد تأثير العلاج بعقار الفينايستيرايد مقابل الليزر منخفض الشدة على نمط سقوط الشعر الأمامي لدى الذكور والإناث . اشترك في هذه الدراسة أربعون مريضاً تتراوح أعمارهم من 35-50 عاماً بمتوسط عمر  $42.25 \pm 1.85$  عاماً . ولقد تم اختيارهم من العيادة الخارجية لقسم الجلدية والتناسلية بمستشفيات جامعة عين شمس . ولقد تم تقسيمهم عشوائياً إلى مجموعتين متساويتين في العدد حيث تم العلاج بعقار الفينايستيرايد بمعدل 1 مجم يومياً عن طريق الفم لمدة ثلاثة شهور بالمجموعة الأولى والليزر منخفض الشدة من خلال مشط الليزر بمعدل جلسة يومياً (20 دقيقة) لمدة ثلاثة شهور بالمجموعة الثانية ولقد تم عمل التقييم الفوتوغرافي من خلال مقياس تقييم السبع نقاط و قياس عدد الشعر قبل و بعد البرنامج العلاج ي لفترة ثلاثة أشهر . وفي نهاية برنامج العلاج كانت متوسطات مقياس تقييم السبع نقاط  $1.1041 \pm 0.2960$  و  $1.1279 \pm 0.2961$  درجة لمجموعة الفينايستيرايد ومجموعة الليزر علي التوالي ، بينما كانت متوسطات قياس عدد الشعر  $8,1763 \pm 26,0101$  و  $8,1664 \pm 26,0112$  شعرة لمجموعة الفينايستيرايد ومجموعة الليزر علي التوالي ، ولقد أظهرت النتائج أن هناك زيادة ذات دلالة إحصائية عالية في مقياس تقييم السبع نقاط و قياس عدد الشعر في نهاية البرنامج العلاج ي بالمجموعتين . و لذا فإن استخدام كل من عقار الفينايستيرايد والليزر منخفض الشدة كانا مؤثر بين و بشكلٍ متكافئ تقريباً في تحسن إعادة نمو الشعر كما هو ظاهر من زيادة مقياس تقييم السبع نقاط و قياس عدد الشعر .