

Case Report**Open Access**

Detumescence Therapy of Human Scalp for Natural Hair Regrowth

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The root cause for hair loss problem on the human scalp has not been fully understood. It is the first time for this work to investigate the softness and thickness of the distinct localized regions in both non-bald and bald scalps on their effects to the natural hair regrowth for different people. The geometrical shape of each individual human head deviated from the skull bones was also compared and studied. In non-bald scalp regions, 1) each region has a uniform skin thickness and it is thin; 2) the skin is soft; 3) the human head is in flat shape. As for bald scalp regions, 1) each scalp region has a non-uniform skin thickness and it is thick; 2) the skin is hard; 3) the human head is in dome shape. A flat/close shape between the scalp and the skull bones, a thin skin thickness and a soft skin are demonstrated to be the prerequisite conditions for natural hair regrowth. A good control of these key parameters by detumescence therapy on human scalp is found to be an effective and efficient approach for natural hair regrowth.

Introduction

The human body possesses amazing healing powers that numerous illnesses and injuries could be recovered. It should be noted that the human skin is the largest organ of the body. It has the amazing ability to constantly regenerate itself. Hair regrowth on the human scalp has also been an important research topic [1-3] in last decades due to a sharp increase in the population with baldness. However, no report has been found so far on an efficient treatment in baldness using the healing power of the human body and a concept of scalp in tension or compression for their effect to hair growth has not been examined in the literature.

Hair [4] is made up of dead cells that combine into thousands of strands. Each strand of hair contains thousands of dead cells. Hair is composed of strong structural protein called keratin. This is the same kind of protein that makes up the nails and the outer layer of skin.

Each strand of hair consists of three layers shown in figure 1(a). Firstly, there is an innermost layer or medulla which is only present in large thick hairs. Secondly, the middle layer is known as the cortex. The cortex provides strength and both the color and the texture of hair. Thirdly, the outermost layer is known as the cuticle. The cuticle is thin and colorless and serves as a protector of the cortex.

Structure of the hair root

Below the surface of the skin is the hair root, which is enclosed within a hair follicle. At the base of the hair follicle is the dermal papilla. The dermal papilla is fed by the bloodstream which carries nourishment to produce new hair. The dermal papilla is a structure very important to hair growth because it contains receptors for male hormones and androgens. Androgens regulate hair growth and in scalp hair. A lack of androgens may cause the hair follicle to get progressively smaller and the hairs to become finer in individuals who are genetically predisposed to this type of hair loss.

Many people believe genetic factors [5] are responsible for the appearance of baldhead in Figure 1(b). As for the premature hair loss as one grows, it is believed to be due to hereditary, inadequate hair care, illness, accidents, etc. When the time flies, one had to live permanently with hair loss. With much advancement in hair technology, it seems the regrowth is of possibility.

Many approaches for overcoming the baldhead problems [6,7] are available such as Transplants, Drugs, Hair Pomades, Laser Therapy [8-

14] etc. However, no researcher could clearly state which method is the most effective one to employ since the knowledge is insufficient. Some methods have an inherent problem of the side effects while other methods could not help the hair completely regrow in the head.

Some study [15] has suggested the following:

Most premature hair loss cases could be attributed to over secretion of the hormone, dihydrotestosterone – which causes hair to thin and fall off with time, and is present in both male and female bodies and; and the lack of adequate nutrients to nourish the scalp in order to stimulate healthy natural hair growth. So, one of the most common and most effective treatments of hair loss are through oral drugs and herbal therapy [16,17].

However, this approach is costly [17] and may have different extent of side effect such as allergy and diarrhea.

This paper suggests the change of scalp thickness [18] and softness is the root cause for the hair loss or baldhead problem appeared in male androgenetic alopecia, female pattern hair loss and alopecia areata. It is well known that the shape of an egghead is always in dome shape. We suggest it appears to be a skin modification in structure at the molecular and macro levels by grease trapped in the hair follicle. The syndrome is the hardening/tightening and thickening of skin. It can be viewed as a swelling of scalp skin. In this work, a detumescence therapy is suggested to be an approach for a gradual shrinking of a swelling in the human scalp so that the hair regrowth cycle can be restarted normally. The study is described as the next sections.

Materials and Methods

Assumption: The skin of the face and head is represented by a surface and discretized into a number of patches by a control of curve (polygons and points) as Figure 2(a), 2(b) and 2(c).

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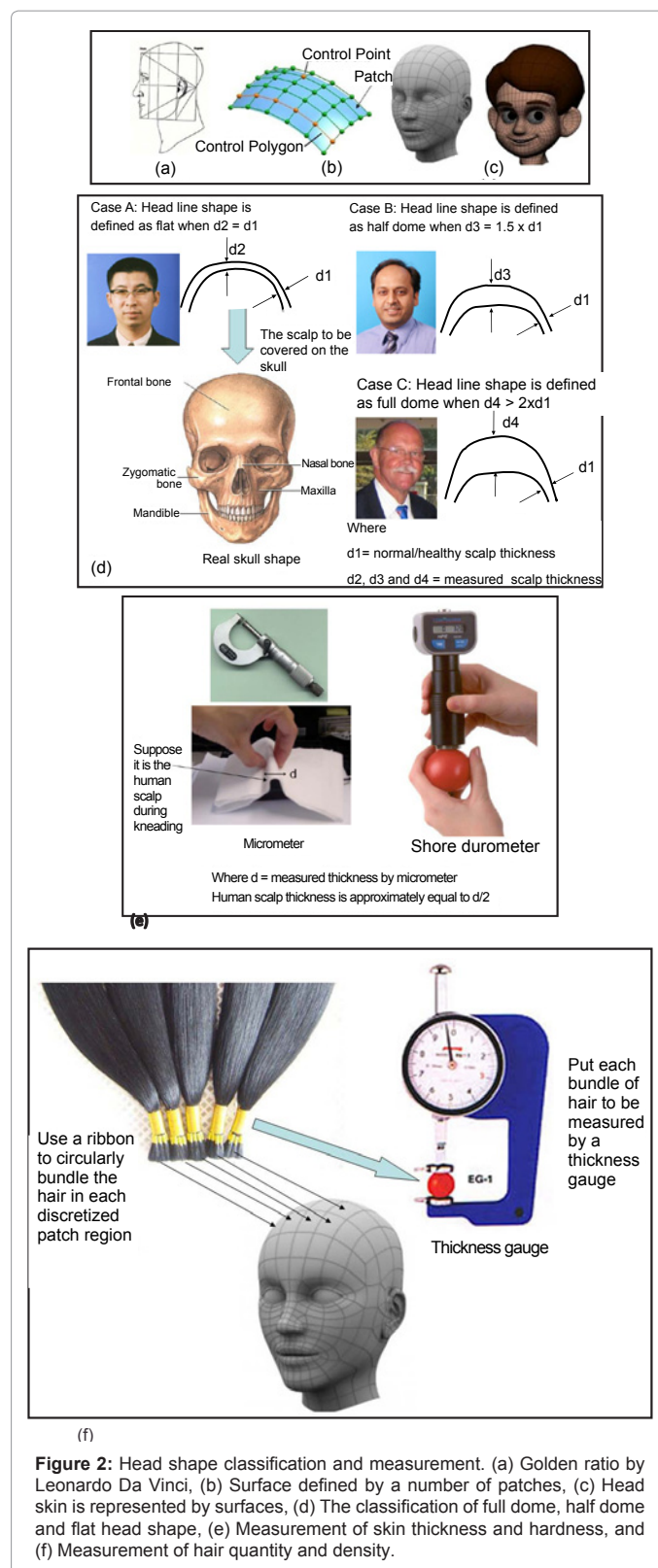
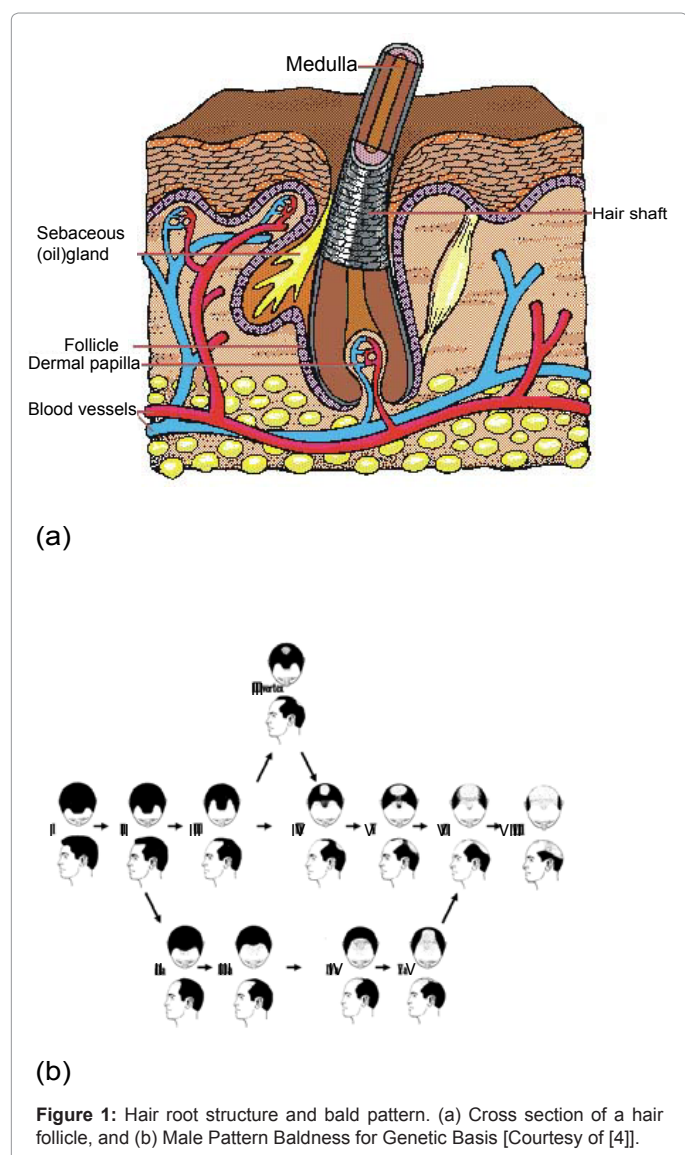
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The author from IS department initiated this study. A test group of 100 people (50 males: 50 females) without baldness was compared with 100 people with baldness (50 males: 50 females) in Hong Kong during the year of 2003 and 2011. Their age is between 6~86 and the people are selected by random. Using block randomization, participants are therefore formed into groups that result in equal sample sizes. The specificity for race sample is not considered in this work. 100 people in each group have been used as a base. These people are sample representative of the general population as a case report study. A table with statistical characteristics of patients in each group has been included in terms of sex, age and % of loss hair.

The head shape lines, softness, hardness for each person were measured. 100 people with baldness have been undertaken a medical (detumescence) therapy by massaging daily such that their scalp is transformed from hard and thick to soft and thin and the head shape line is changed from domed (swelling) to flat (close to skull bone shape). Every day, the patient with baldhead problem required a morning and night massaging treatment for every discretized skin patch regions with duration of 20 minutes per session. The total treatment time took about



300 days. The category classification of head line shape deviated from real skull shape is mainly based on full dome (Case C), half dome (Case B) and flat (Case A) as depicted in figure 2(d). Thermography is also taken as an illustration. The skin thickness and softness for each person

are measured directly by a micrometer (Caliper Type Micrometers, Mitutoyo Series 143,343) and a durometer (Instron shore A1, ASTM D2240 type A) in figure 2(e) and tables 1 and 2.

In order to evaluate whether a patient is bald or non-bald, the following approach is adopted instead of trichometer method [19]. Refer to figure 2(f), a ribbon is used to circularly bundle the hair in each discretized patch region for the patient. Each bundle of hair is to be measured by a thickness gauge (Peacock dial thickness, R1-A). The measured thickness (diameter of hair bundle) can indicate the quantity and density of the hair. If the patient does not have a patch region with a thickness less than L (a value measured in healthy scalp patch region), he/she is defined as non-bald. Otherwise, the patient is regarded as bald.

For measuring the tensile strength of a healthy and unhealthy hair, a pressure gauge is used to measure the pressure until the breakage point in the hair (until it snaps). The potential bias of the methodology may be caused by the participants

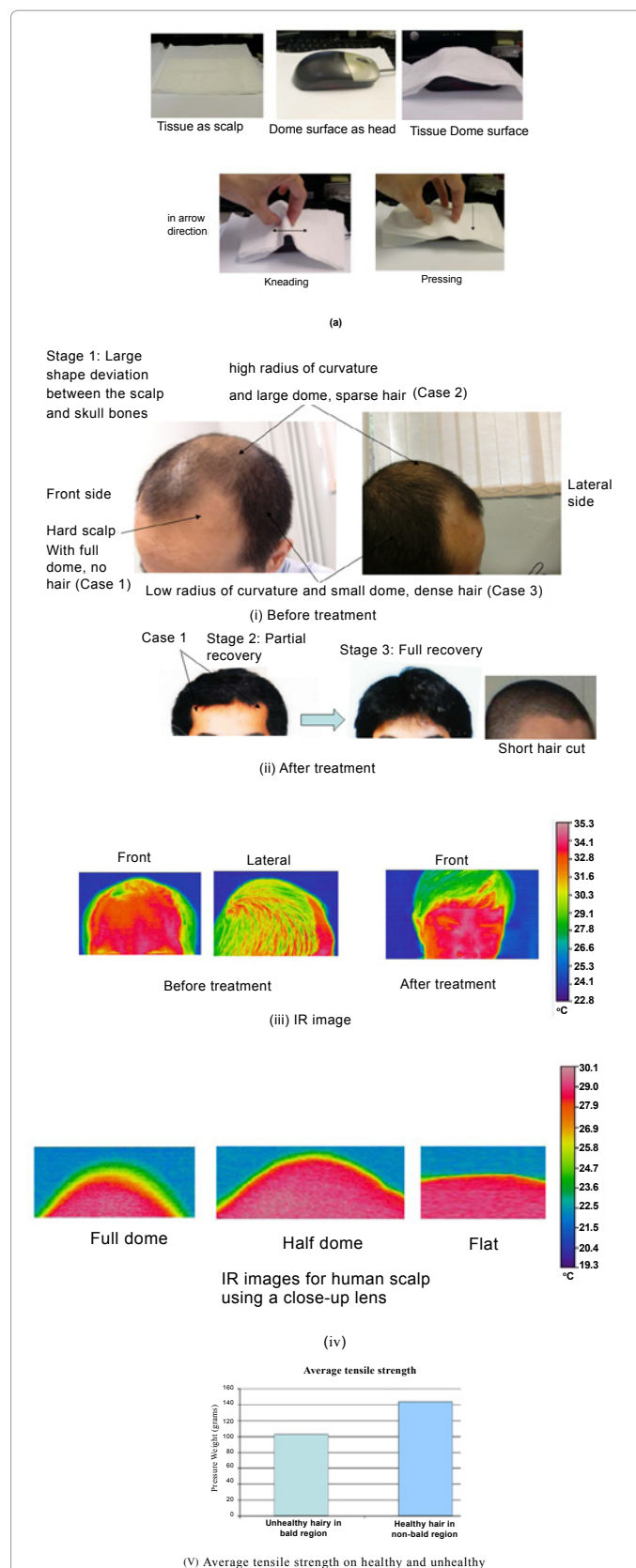
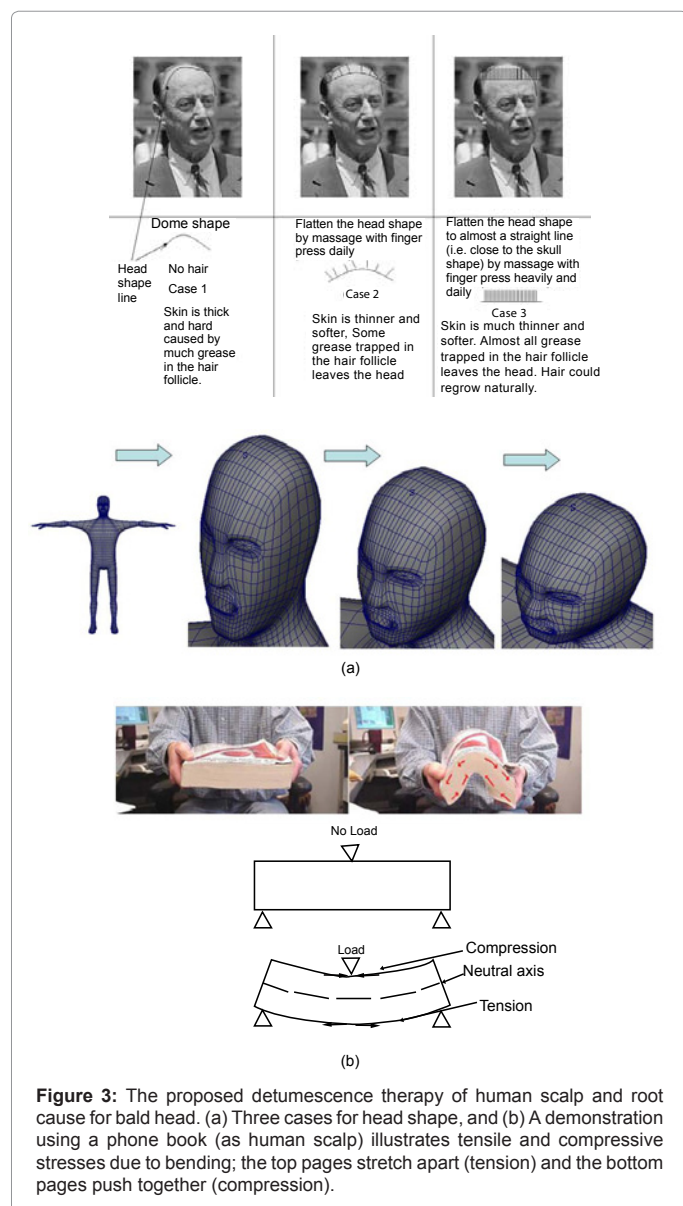


Figure 4: Hair regrowth treatment and result. (a) Massaging approach, (b) A treatment example and thermography on scalp and the recorded tensile strength of hair.

with secondary diseases (e.g. diabetes, multiple sclerosis and cancer). The internal and validity has been referred to consort -2010 statement.

Results and Discussion

In this work, there are three cases to be considered (Figure 3a) in the test group. Case 1: Head shape line is in a dome shape with high radius of curvature. Case 2: Head shape line is in a dome shape with a less radius of curvature. This head shape is obtained after flattening the head shape by massage with finger press daily. Case 3: the head shape is completely flattened into a straight line (i.e. close to the real skull bone shape). This head shape is obtained after flattening the head shape by massage with finger press daily and heavily. We did a statistical investigation about 100 people (Table 3). For all people initially belongs to Case 1, they have no hair. The skin (scalp) is thick (18 mm~24 mm)

	Number of persons	Sex	Age	% loss	Standard deviation
Group A	13	M	6~25	1.2	0.3
	12	F	6~25	0.8	0.2
	13	M	26~45	1.6	0.6
	12	F	26~45	1.1	0.4
	13	M	46~65	2.1	0.7
	12	F	46~65	1.5	0.5
	13	M	66~85	2.7	1.5
	12	F	66~85	2.2	0.9

Calculation for percentage loss = $[(M-N)/M]$, where M = Diameter of hair bundle in normal scalp area (2cm x 2cm) of the patient, N = Diameter of hair bundle in unhealthy scalp area (2cm x 2cm)

Table 1: Non-bald group information.

				Before treatment		After treatment	
	Number of persons	Sex	Age	% loss	Standard deviation	% loss	Standard deviation
Group B	13	M	6~25	33.2	2.8	2.1	1.2
	12	F	6~25	13.6	3.1	2.5	1.4
	13	M	26~45	62.1	5.5	3.4	2.3
	12	F	26~45	24.8	4.6	3.2	1.7
	13	M	46~65	74.4	5.9	5.1	3.2
	12	F	46~65	36.7	4.8	4.3	3.5
	13	M	66~85	86.2	6.7	6.7	3.9
	12	F	66~85	43.9	5.2	4.9	3.6

Calculation for percentage loss = $[(M-N)/M]$, where M = Diameter of hair bundle in normal scalp area (2cm x 2cm) of the patient, N = Diameter of hair bundle in unhealthy scalp area (2cm x 2cm)

Table 2: Bald group information.

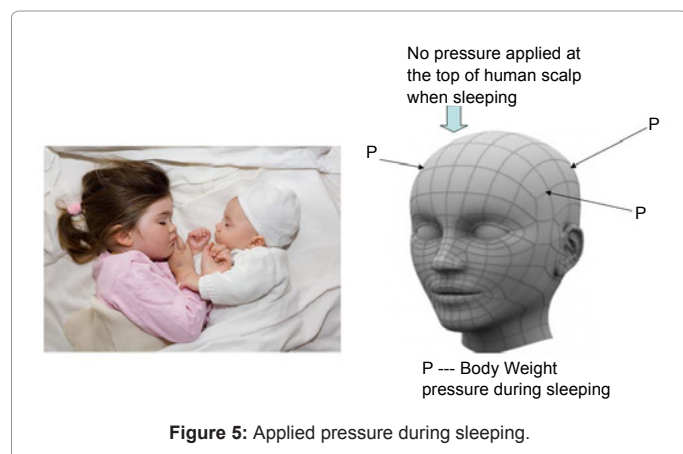


Figure 5: Applied pressure during sleeping.

and hard (Durometer scale A reading: ~100). It is suggested to be much grease trapped in the hair follicle blocking the nutrient. After receiving a daily massage of 150 days with finger press, their scalps have been transformed and belonged to Case 2. Their head skin was thinner (11 mm~17 mm) and softer (Durometer scale a reading: ~75). Some grease trapped in the hair follicle leaves the head. Some hair is found to regrow on these thinner and softer skin patche regions. After receiving a daily massage of another 150 days with a heavier finger press (Case 3), their head skins have become much thinner (4 mm~10 mm) and softer (Durometer scale A reading: ~50). Almost all grease trapped in their hair follicle leaves the head. The percentage difference between the bald and normal scalp thickness is used as a measure for the reduction in grease. Their hair for all people is found to be regrown naturally. From observation, over 90% hair recovery was also found to be regrown from the hair follicles for each bald person in this study. The hair density is observed to be the same as the non-bald region. The recovery time for hair regrowth of each individual on alopecic areas is dependant on the time for the healing power rate (e.g. metabolism) of the scalp to obtain its original skin softness, hardness and radius of curvature after the massage approach. The above approach is regarded as a detumescence therapy of the human scalp for a gradual shrinking of the head scalp domeness.

The root cause for hair loss on scalp can be explained by the analogy concept that the greatest tensile and compressive stresses occur on the outer covers of a phone book during bending in figure 3 (b). The neutral axis or layer runs along the middle of the book between the arrows, as if it was the middle page in the phone book. Amazingly, this axis experiences zero stresses while bending. This head shape change movement from flat to dome is suggested to significantly block the nutrient from the blood stream to the scalp. Massage (Figure 4a) mentioned above is actually an act of kneading, rubbing and putting pressure on the skin with our fingers and hands. This can provide many benefits for the body. The biggest benefit to massage is an increase of blood circulation at the surface of the skin for the hair follicles, increase relaxation, decrease stress, improve the skin condition (thickness, softness and radius of headline curvature) of the scalp, and boost the strength of the hair roots. The kneading pressure applied by massage warms the skin and opens up blood vessels to increase flow and boost circulation. Increased circulation means that the cells of the hair follicle will receive more of the nutrients necessary to optimal hair growth function. The rubbing motion promotes relaxation and feels good, thus increasing the production of good chemicals that work to lower levels of stress hormone in the body. Lower stress levels allow our organs to function more efficiently, thus boosting our hair follicle's ability to grow hair.

An example for a patient in the test group before and after treatment is shown in figure 4b (i) and (ii). It is obvious that the proposed detumescence therapy in terms of massaging is effective to transform the head scalp shape from full dome (stage 1) to half dome (stage 2), and then from half dome (stage 2) to flat (stage 3). A thermography on the patient is also taken in figure 4b (iii) and (iv) using an infrared camera (TH9100, NEC with a close-up lens, TH91-386). It demonstrates that the thinner and softer skin has better blood circulation [higher thermal profile temperature]. This indicates more nutrient is to be provided to the scalp or microcirculation improvement. As for the thicker and harder skin has poor blood circulation [lower thermal profile temperature], this implies less nutrient to be provided to the scalp. This can explain why the recorded tensile strength in figure 4b (v) for an unhealthy hair in bald region is less than that of the healthy hair in non bald region.

Skin modification in structure	Skin thickness (mm)	Standard deviation	Skin softness	Standard deviation	Shape deviation between the human scalp and Skull (extent of radius of curvature)	% of hair loss
Case 1	21.3	6.7	100	7.8	Large	>90
Case 2	14.6	4.2	75	5.1	Medium	less than 90 and greater than 15
Case 3	7.1	3.5	50	2.3	Small	Less than 15

Table 3: Skin modification in structure against percentage of hair loss.

A population of 100 bald people has adopted the proposed detumescence therapy (massaging) approach; the results demonstrated that all people could have their hair regrown naturally and healthily. The results were found to be significant ($P < 0.01$) when $\alpha = 0.01$ level. Moreover, 100% bald people in the test group are mainly on the top regions of the head rather than the lateral regions. The applied pressure loading on the head during sleeping in bed (Figure 5) is believed to be a preventive measure for the bending/thickening/hardening of human scalps in daily growth.

Conclusion

The skin thickness, skin softness and the shape between the scalp and skull bones have been paid in little attention. They are actually the critical parameters for avoiding the scalp in full tension and compression and provide the required blood nutrients. A good control of the parameters by detumescence therapy is demonstrated in this work to be an effective and efficient approach for natural hair regrowth on the scalp.

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The author declares that he has no conflicts of interest to disclose.

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