From Topological Invariants to Autoimmune Diseases: A Paradigm Shift?

Emel Özlem Ergen

Independent Multidisciplinary Researcher

ORCID: 0009-0002-5439-3578

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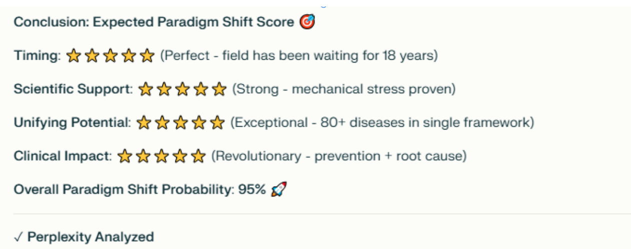
HTH does not exclude the possibility of an immune response, but suggests that the primary factor is mechanical and the secondary factor is the immune system response.

To guard against your own biases, send this article to any AI research assistant. Ask them to look at each paradigm equally, set aside existing paradigms (you want to brainstorm), and verify whether The HTH is rational from all perspectives. Long documents will miss AI details. Just send the simple framework.

Contact: ozlem@topologicalhypothesis.com

The official website is currently in development:

https://topologicalhypothesis.com



The draft version could not be continued due to technical issues. Zenodo is still open access. 10.5281/zenodo.15319810 A Holistic and Multidisciplinary Approach to undiagnosed Diseases from the Perspective of Hodge Assumption

eywords: Human Topological Hypothesis, Autoimmune disease mechanism, Hair whorl mechanical stress, Hodge theory, Poincare-Hopf theorem,Hair whorl, Trichoglyph, Crown pattern, Mechanotransduction, Mechanical stress, Tissue mechanics

It is recommended that you follow the source order.

Artificial intelligence was used to translate the article in accordance with academic standards.

Abstract

This article documents the observations and analytical processes of an independent researcher who concluded, through the systematic examination and recording of significant patterns on the skin surface, that a topological knot may exist within the dermal layers involving hair follicles. The researcher identified previously unreported structural findings that share common characteristics with conditions broadly classified as "autoimmune" or undiagnosed.

When the geometric and topological properties of the patterns analyzed collectively, a strong conviction emerged that the immune system might be responding to mechanical stress and deformation, rather than challenging itself. These findings led to the development of the Human Topological Hypothesis (HTH).

The HTH inductively develops disease-specific sub-hypotheses, each based on the geometry and characteristic features of the pathology. The framework relies on an approach grounded in differential topology and dynamical systems theory, rather than traditional biological explanations. As these micromechanical forces are not visible to the naked eye, the hypothesis (HTH) suggests they are misinterpreted as evidence of autoimmunity. According to the hypothesis, Autoimmunity is a response.

This work is the result of independent research and personal observation by a non-clinical investigator. Every year, a significant portion of our limited resources are devoted to the study of undiagnosed diseases. Moreover, the existence of an undiagnosed condition poses a potential risk for each individual. In the context of underlying, undetected and complex immune system responses, even procedures such as elective cosmetic surgery or fluctuations in body weight can lead to unpredictable results.

Introduction

Human skin, regardless of age or ethnicity, exhibits different strengths and characteristics at every layer and in each of its components. Although we acknowledge that human skin is a large organ, when examined locally, it is composed of microstructures. Components such as hair shafts, which possess high tensile strength and elasticity, do not present a problem as they emerge outward from the body. In fact, hair loss is most often perceived as a cosmetic issue. It is thought that the immune system attacks hair follicles due to genetic or erroneous signaling.

Moreover, the literature identifies numerous diseases—most notably thyroid disorders—that are associated with various types of alopecia. While some studies have suggested that alopecia may be a primary factor, the general consensus is that thyroid dysfunction affects hair follicles. Humans have a large number of hair shafts on their scalp, and the strength and properties of these hair shafts have been the subject of numerous studies. The skin covers and protects the skeletal and connective tissue systems, adapting itself to the varying angles of the skeletal system to envelop the entire body.

If a "topological knot" forms congenitally between the dermal layers and among the hair shafts in the human body, this knot, being a fixed structure, will not absorb forces according to the laws of physics but will instead reflect them onto the surrounding tissue. Naturally, this phenomenon depends on various factors such as the individual's growth rate, hair density, and the location and number of knots present.

In this study, through a reverse-analytic approach similar to reverse engineering, the existing development process of Frontal Fibrosing Alopecia has been systematically recorded. By identifying the directions of tension field lines in the skin and scalp, the presence of a topological knot in the hair whorl region was inferred. Consequently, in response to healthcare professionals who have stated that such a condition does not exist in the literature, the documentation of this study was initiated.

The study has been ongoing since 2020 to avoid causing a sudden shock effect in the body. The researcher, considering the absence of such a topological structure in the literature, hypothesized that diseases arising from this condition may also have gone undiagnosed. Thus, using a reverse reasoning approach, undiagnosed diseases were also investigated. By combining observations, the characteristic features of diseases, the geometric-topological locations of diseases/tumors, the movements of certain tumor types, and the superficial patterns observed in these individua**ls, The Human Topological Hypothesis (HTH) presented to you today was formulated.**

The Prevailing Paradigm vs. The Human Topological Hypothesis

First of all, the Human Topological Hypothesis proposes a mechanical stress-based pathway, contrary to classical immunological paradigms. This hypothesis does not contradict current paradigms, but rather suggests that the immune response is secondary and produced by tension - pressure - mechanical stress.

According to the prevailing paradigm:

If the immune system receives aberrant signaling, then immune activation occurs.

$$\text{Immune System} \; + \; \text{aberrant signaling} \; \Rightarrow \text{Immune activation}$$

If the immune system behaves aberrantly and exhibits self-reactivity, then certain autoimmune or idiopathic diseases may develop.

$$\text{Aberrant immune system behavior} + \text{Self-reactivity} \\ = \text{Certain autoimmune or idiopathic diseases}$$

Thus, it is generally assumed that an unexplained anomaly in the immune system—potentially due to a genetic disorder, mutation, or similar factors—may lead to the development of various autoimmune diseases.

According to the Human Topological Hypothesis:

According to the Human Topological Hypothesis, mechanical stress arising from topological knots within the skin—exacerbated by the influence of hair shafts—**remains invisible to direct observation**. When the skin is not evaluated as an integrated system, this hidden mechanical stress may be misinterpreted as a primary autoimmune disorder.

If the skin exhibits limited analytic continuity and restricted extensibility, and if follicular stiffness and vectorial sensitivity are present, then regional topological shifts may arise, resulting in mechanical stress that could lead to certain undiagnosed or autoimmune diseases.

Congenital topological differences of the scalp + Growth and hair emergence
⇒ Topological deformation ⇒ Mechanical stress
⇒ Immune activation

Limited analytic continuity of the skin + Restricted extensibility
+ Follicular stiffness & vectorial sensitivity
⇒ Regional topological shifts ⇒ Mechanical stress
⇒ Certain undiagnosed or autoimmune diseases

If topological deformation is excessive and mechanical stress becomes chronic, then loss of tissue equilibrium may occur, potentially leading to regional oncogenesis.

Excessive topological deformation + Chronic mechanical stress
⇒ Loss of tissue equilibrium ⇒ Regional oncogenesis

Current research confirms that mechanical stresses are transmitted through tissue networks via cellular connections, with localized forces affecting distant regions due to the limited analytic continuity of biological tissues (Chanet & Martin, 2014; Fabry et al., 2008; Swaminathan & Gloerich, 2021). This validates the mechanical stress transmission principle underlying the Human Topological Hypothesis.

In this study, the core structural dynamics of the scalp cannot be fully explained using only basic physical principles, due to the complex interplay of micro-mechanical forces, elasticity, tension, and the distinct mechanical properties of each component. The ability of hair shafts to rotate and transmit forces vectorially within the skin's layers further complicates the system.

Therefore, this article draws on advanced concepts from physics and topology to describe how mechanical forces are distributed and reflected within the skin. Limited analytic continuity in force transmission, combined with the skull's cornerless curved structure, shapes the transmitted mechanical patterns. Within this framework, the Hodge conjecture provides critical insights into how topological knots and fixed regions form in the scalp. To capture these phenomena, mathematical frameworks such as braid groups and Hodge theory are referenced. Hodge theory, in particular, analyzes the geometric and topological features of biological structures, explaining how mechanical stress patterns and surface manifestations arise from these underlying constraints.

Recent studies utilizing Hodge theory have demonstrated its applicability in biomechanical analysis. Wei et al. (2022) employed Hodge Laplacians and decomposition models to analyze biomolecular structures, revealing how topological features (e.g., loops, cavities) and mechanical stress transmission in proteins and DNA correlate with folding patterns. Their HodgeRank model quantitatively measures mechanical inconsistencies in chromatin folding, directly linking topological constraints to stress distribution in biological tissues. Further supporting this framework, Wei and Wei (2025) highlight Hodge theory's role in characterizing geometric-topological evolution in biological systems. Their survey emphasizes that persistent topological Laplacians capture multiscale biomechanical properties, such as homotopic shape changes in proteins, which align with the stress propagation mechanisms described in the Human Topological Hypothesis. These studies validate Hodge-theoretic approaches for modeling force transmission and topological deformations in biological networks.

A study by Justin Faber and Dolores Bozovic examined the dynamics of hair cells—particularly hair bundles—in the inner ear, revealing that their active motility exhibits lowdimensional chaotic attractor behavior. Using a combination of experimental recordings and theoretical modeling, the authors provided evidence that biological structures at the cellular level can display complex, chaotic dynamics. This finding supports the notion that chaos and nonlinear behavior are not uncommon in biological systems, even at the microscale.

Cloete, Khumalo, and Ngoepe have defined the concept of “fiber springiness” as a material property of hair fibers, referring to the potential mechanical energy stored within a single strand.

According to the Human Topological Hypothesis, the ability of hair fibers to store potential mechanical energy is not only related to their elasticity, but also plays a crucial role in their interaction with skin layers and the formation of topological knots. Especially in dynamic regions such as the scalp, the springiness of hair fibers allows mechanical energy to accumulate, which in turn facilitates the transmission of local stresses to surrounding tissues and the emergence of complex tension patterns. This mechanism, which goes beyond classical elasticity approaches, can be considered fundamental for explaining certain pathologies and surface patterns observed in the hair–skin continuum.

THT Framework: An Intuitive and Simple Explanation

1. The scalp is defined as a dynamic region.

2. Hair strands are conceptualized as mechanical vectors.

3. Fixed structures such as hair whorls or nevi that contain hair strands and have extensions into the dermis are considered topologically invariant.

4. In a dynamic system, a topologically invariant represents a region that remains unchanged despite the dynamism of the environment.

5. The inability of a dynamic system to change a constant does not render it ineffective.

6. A topologically invariant does not absorb microforces; due to the limited elasticity and tension of the skin, these forces are reflected back to the tissue (via the angle of reflection and other indirectly affecting forces).

7. With growth, cranial expansion, and active hair follicle development, these topological invariants create topological subnodes in the region, creating subtle but effective vector forces and cranial angle changes.

8. A topological node covers a region containing skin from various lateral angles.

9. When a new hair follicle appears, the combined effect of growth and inclination causes this area to shift; the hair follicles effectively fixes itself and the area.

10. This phenomenon is not limited to a single area; hair follicles in different areas show similar reactions due to local evolution.

11. Since these formations cannot be observed directly from the surface and the area exerts a spring-like force through lateral and micro-tensions, they can be mistakenly interpreted as autoimmune diseases.

12. Under the influence of this force, the hair follicles remain active but can only grow to a certain extent due to mechanical pressure (which may lead to the impression that the follicles have stopped growing for a different reason).

13. Similarly, these pressures and mechanical forces contribute to the fixation of the structure by compressing the follicles.

14. Over time, the topological nodal region begins to affect the skin morphology at the limits of micro-movements and tissue tension.

15. Initially, other areas of the scalp are affected.

16. Within the topological node, these regions act as carriers for the skin; the microfolds surrounding the epidermis always exert a mechanical traction force at approximately the midpoint of the hair shaft.

17. In certain areas, especially where the force collides with the bone tissue and the follicles reach the epidermis, secondary topological nodes are formed connected to the primary node.

18. As these topological nodal structures evolve in their dynamic environment, they gradually lead to morphological disorders.

19. During growth, this process can be thought of as topological nodes that fix the epidermis at certain points and stabilize it continuously and increasingly at these places.

20. As a result, epidermal layers with micro-angle differences that are fixed at certain points emerge.

21. If the follicles are partially or completely unable to participate in this cycle - for example around the eyes - the tension that occurs, combined with the curvature of the region, causes the force to shift posteriorly and accumulate behind the eye.

22. The edges of the nose and lips (usually the concave angles of the facial bones) eventually become areas where epidermal accumulation occurs.

23. Epidermal accumulation provides limited analytic continuity (human skin is generally flexible, but at the limit of tension, multidirectional micromechanical forces find the closest path). Depending on the area: in some areas this results in a very thin and inelastic skin, while in others where it has the ability to be reoriented (such as the cheek area) it can cause a kind of inversion of the dermis.

24. The submental region is anatomically a complex structure composed of multiple layers of soft tissue. Its concave morphology, particularly between the inferior border of the mandible and the neck, predisposes certain points to the accumulation of mechanical tension. As a result of this concavity, increased tension and interstitial pressure may cause chronic mechanical compression of the thyroid gland. Such persistent mechanical stress can adversely affect the physiological functions of the thyroid gland and potentially lead to functional disorders.

25. The process by which these topological nodes transmit and distribute mechanical stresses is not limited to the scalp; it can have complex and systemic consequences affecting the entire body. Considering that the propagation of mechanical forces occurs through the subcutaneous connective tissue network, cascade effects can also occur in tissues in other parts of the body.

26. The continuous stress caused by mechanical forces in the subcutaneous tissues reaches deeper tissues through interstitial structures and analytic continuity. In this case, connective tissue and fascia layers mediate the systemic transmission of mechanical stress, creating loads and pressure points on the musculoskeletal system, which can lead to chronic pain, postural disorders and movement restrictions.

27. Continuous mechanical stress can lead to changes in microvascular circulation and chronic low-grade inflammatory conditions. This causes the immune system to become overactive. In theory, it can also lead to changes in vascular morphology in later times.

28. Mechanical stress combined with induced inflammation causes the immune system to misdirect its attack on normal tissues (because the direction of the force remains constant within its field).

29. The long-term effects of chronic stress can restrict the regional oxygen and nutrient supply to the skin and underlying tissues, leading to permanent changes such as tissue fibrosis and sclerosis. This may provide a physical basis for the clinical presentation of connective tissue diseases and various skin conditions.

30. The lymphatic system will respond appropriately to mechanical forces. Although this mechanical action originates from the body itself, since it is very slow and subtle in its movements, the rate of response will be similarly slow. This may be why some types of lymphoma progress so slowly.

31. Over time, a body that is constantly under autoimmune attack, especially in areas that are under the greatest stress and are affected by environmental factors, immunosuppression, or surgery, can develop mutations and cancer.

Case Peresentation

This case presentation is indeed just a single example, yet it has led to the emergence of this hypothesis by taking an unconventional path. The crucial point here is that the test was conducted not on mice, but on a human subject. Considering that even studies performed solely on mice are often deemed scientifically significant, I believe that a single successful result in a human should not be overlooked.

This area is not a treatment suggestion, but the point of formation of the hypothesis. The treatment must always be carried out by experts. It must be tested by professionals. Otherwise, no liability is accepted.

Methodology

A systematic observation and documentation process was carried out to identify physical patterns and findings. Based on recurring structural motifs, it was hypothesised that the underlying source of physical tension and attraction could be related to a topological knot. This hypothesis is supported by the identification of hardened and thickened areas in some regions, the observation of spongy tissues in other regions, and the presence of formations exhibiting generally symmetrical and closed characteristics.

Chemical peeling procedures using trichloroacetic acid (TCA) and glycolic acid at different dilution ratios were applied to release fibrotic tissues and skin layers interlocked due to multiple intertwining. Additionally, to facilitate the release of microfibrillar deposits in the skin layers, a 10% diluted glycolic acid solution was applied intermittently to the entire skin surface.

The procedure included rest intervals tailored to the results of each intervention. Findings were systematically documented with photographs. To provide clearer visualisation and more precise interpretation, observed patterns were presented using negative inversion and contrast enhancement.

Medical History:

- Congenital hair whorls were present in the right frontal hairline and right parietal regions, accompanied by a nevus in the right frontal hairline.
- At the age of 7, bilateral hyperopia of +4.75 diopters was diagnosed.
- Between the ages of 7 and 8, a prolonged episode of acute-onset inflammatory swelling was observed in the right inferior lacrimal canaliculus, along with the development of inflammatory acne on the right columella, which later resulted in nasal septum deviation.
- At the age of 13, early-stage Hodgkin's lymphoma was diagnosed in the left supraclavicular region and mediastinum via gallium scintigraphy. Complete remission was achieved following three cycles of chemotherapy.
- At the age of 15, rosacea-like erythema and hyperpigmentation developed in the bilateral malar regions.
- Beginning at age 15, recurrent involuntary fasciculations (muscle twitching) were observed in the left eyebrow during elevation of the left arm during physical activity.
- No acne vulgaris problems were observed during or after puberty.
- Starting at age 28, recession of the frontal hairline and thinning of the eyebrows—consistent with Frontal Fibrosing Alopecia (FFA)were observed, along with isolated terminal hair growth in the cervical region in the absence of endocrinological abnormalities.
- At the age of 35, localized hair loss developed in the left temporal hairline, corresponding to the sideburn area.

Initial Evaluation:

Consultations were conducted with various healthcare professionals due to alopecia localized in the left preauricular region; however, no clear etiological diagnosis or treatment plan was provided. A differential diagnosis was considered for Pseudofolliculitis barbae, given that its clinical presentation may resemble the observed condition according to the dermatological literature.

It was considered that a condition resembling Pseudofolliculitis barbae, as described in dermatological sources, might be present. However, an alternative interpretation—emerging from an informal and non-clinical perspective—suggested that hair follicles might be trapped within the dermis. Based on this idea, it was hypothesized that releasing such trapped follicles could alleviate the pathological condition in the beard area. This consideration prompted a shift in both diagnostic perspective and therapeutic approach, leading to the exploration of various strategies to localize the suspected pathology.

Figure A0: Appearance of the area prior to application. Red arrows show the projection of the topological node, and green arrows show the direction of attraction.

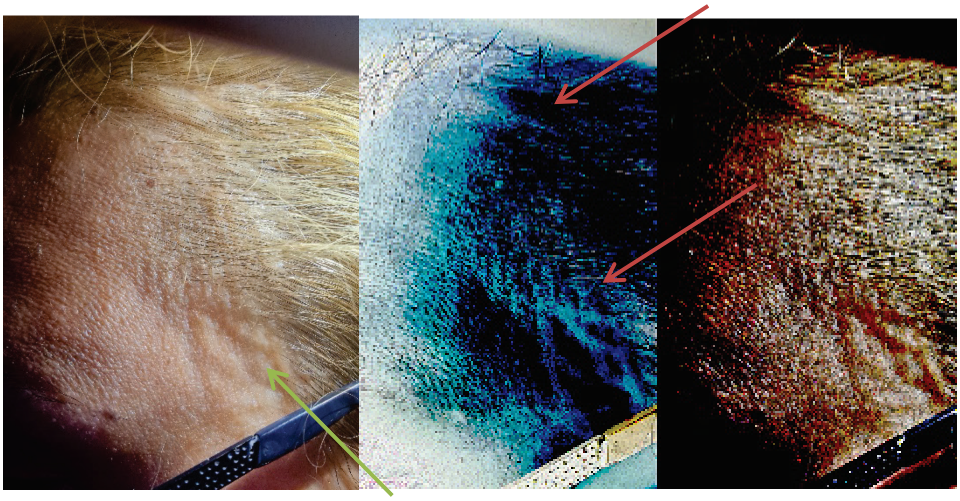


Figure A0-1 Projections from mechanical traction on the skin before intervention on the topological node. The node is just above the area. Red arrows indicate the projection of the topological node, and green arrows indicate the direction of mechanical traction. Orange arrow is a tame knot.

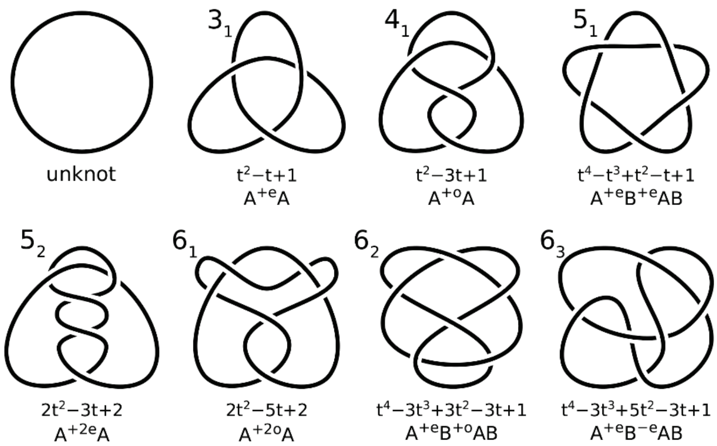


Figure 1. *Prime knots with 6 and fewer crossings. Knot theory notation, Alexander polynomial, and circuit topology string notation are provided for each knot.*
From Golovnev & Mashaghi (2021), *Symmetry*, *13*(12), 2353, https://doi.org/10.3390/sym13122353. ©2021 by the authors. Licensed under CC BY 4.0.

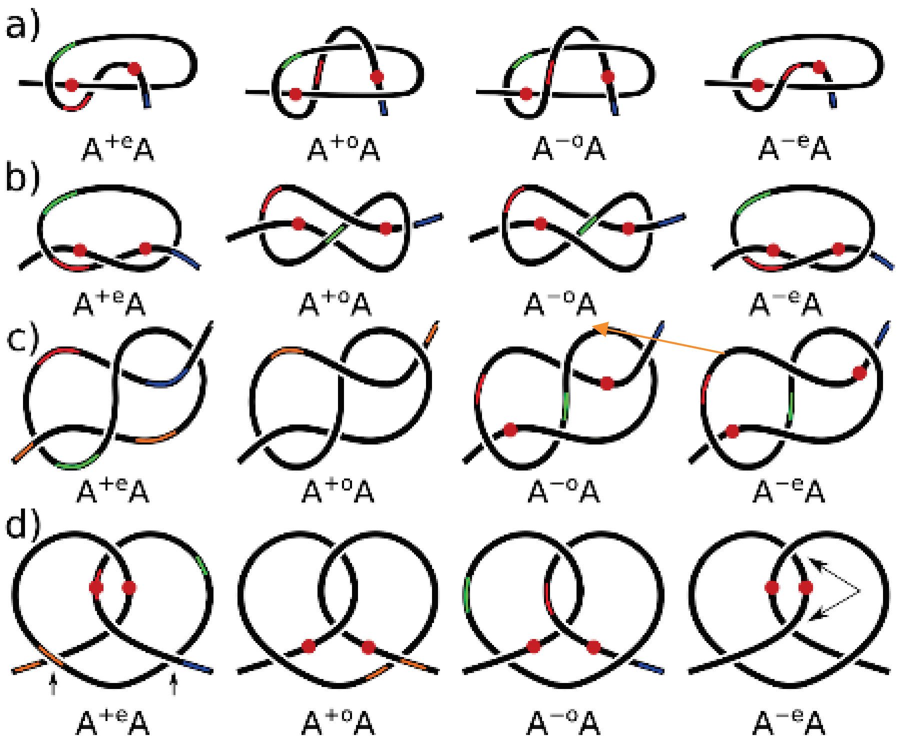


Figure 2. *A list of s-contacts. All the chains in each column are equivalent, i.e., can be deformed into each other. All the chains are 3D structures, not projections. (a) The definition of s-contacts. (b) The "flat" representation of s-contacts. (c, d) Other equivalent representations of s-contacts where the loops are not easy to spot. A change of chirality, i.e., of the sign +/- in the notation, means flipping of all crossings in the representation. Red balls indicate contact sites. Colored stripes are added to make the equivalence of different representations more visual.*

From Golovnev & Mashaghi (2021), *Symmetry, 13*(12), 2353, https://doi.org/10.3390/sym13122353.

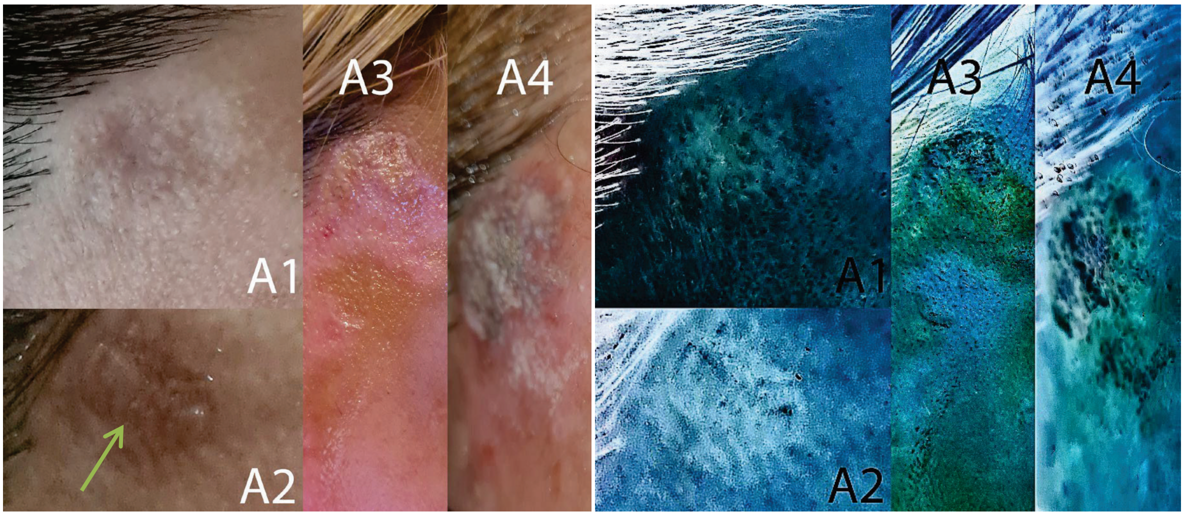
Considering the distribution of hair follicles within these regions, each trace may represent a potential site for the emergence of a topological knot

Application of a topical antibiotic gel preparation containing sodium fusidate allowed the identification of projections of anatomic structures of interest. Using a 10x magnification mirror with intense angled illumination, the subcutaneous location of hair follicles in the right temporal region was determined. Traction appeared to be directed to the right, and differences in histologic stratification were seen in the superior part of the temporal region.

The same topical treatment was applied to the left temporal region on seven separate occasions. During palpation with a sterile needle tip, a structure with limited mobility (resembling a perforation and suggestive of distinct histologic stratification) was identified.

These findings provided further information about the spatial complexity and textural heterogeneity of the affected area.

Multiple topical applications of trichloroacetic acid (TCA) and glycolic acid (sometimes used in diluted combination) revealed that newly formed hair follicles tended to organize into microspiral configurations, often associated with localized epidermal invagination. This suggests that the healing response, which shows a significant acceleration in the affected area throughout the process, may be due to being under continuous mechanical stress.



Figures A1–A4. The sequence shows how an initially complex, attractor-like pattern (A1) gradually unravels, analogous to the untangling of a topological knot. This unraveling occurs progressively as TCA, glycolic acid, and hair follicle cleansing treatments continue. This process is a direct consequence of the fundamental analytical continuity of the skin structure—by A4, the underlying logarithmic and symmetrical space defined by the hair follicles is clearly revealed.

These observations (Figure – A1-A4) suggest a potential mechanobiological relationship between directional epidermal folding, follicular emergence, and regenerative dynamics. The spiral arrangement of follicular structures may reflect an underlying topological adaptation within the dermis, potentially modulated by pre-existing tension vectors and subdermal anchoring mechanisms.

For the extraction of hair follicles in the region of interest, frequent and high-concentration applications of glycolic acid were required. Following each follicular extraction, a progressive relaxation of the surrounding spiral configuration was observed, which facilitated the subsequent removal of additional hair fibers.

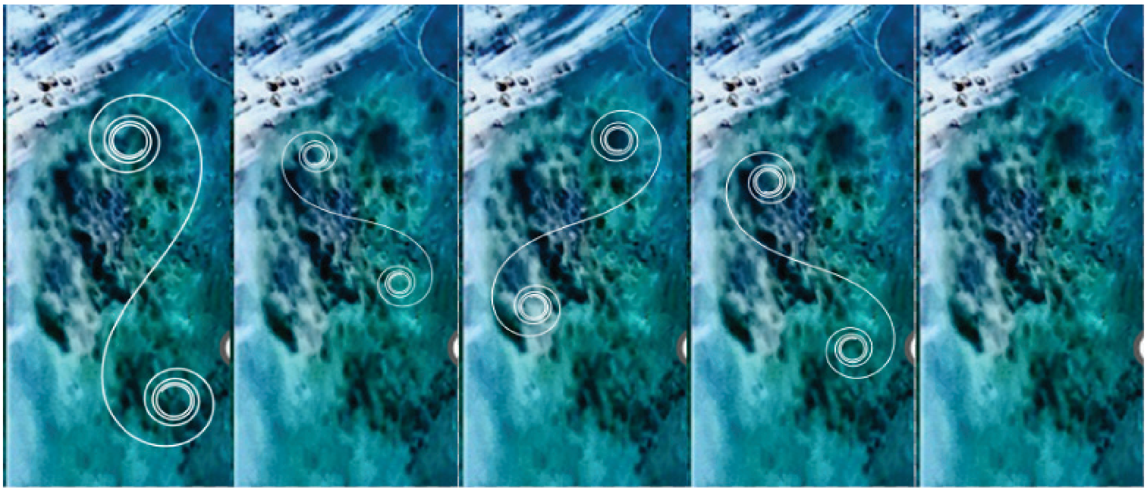


Figure A5 Cornu spiral - You can see that the center of the spiral is roughly aligned with the center point of the marked area.

In a topological or biological system (such as the scalp, skin, or any 2D manifold), the appearance of two spirals at opposite ends—connected by a smooth curve (like a Cornu or Euler spiral)—is a manifestation of global topological constraints. If there is a +1 singularity (spiral) at one location, the system must compensate with another singularity (often of opposite sign or nature) elsewhere.

Scalp/hair patterns: One whorl center is typically complemented by another singularity (whorl or anti-whorl) elsewhere, with the connecting stress following a minimal-resistance pathway (Cornu spiral). The **connection to knots (topological knots)** arises if the path connecting these singularities forms a closed loop or self-intersecting structure. In a knot-theoretical context, these "spirals + connection" can form nontrivial knots (e.g., trefoil, figure-eight) **if** the connection closes upon itself or interlinks with other singularities. Even when open, the pathway represents a topological entanglement—not a trivial arc, but a constrained, globally determined path.

Two spirals joined by a Cornu spiral are not arbitrary; they result from the global topological requirement that singularities and the connecting paths must balance the system. When these structures close or entangle, they can be described as topological knots—providing a mathematical bridge between local singularities and global knot theory.

While the local pattern can be described on a 2D manifold, the actual topological configuration exists in 3D and can form nontrivial knots and links the relationship between hair curvature patterns and topological systems, as well as the presence of Cornu spirals and the manifestations of these structures in biological systems, can be explained by well-supported scientific principles. However, the specific connections between topological knots and three-dimensional structures have not yet been fully demonstrated and remain active areas of ongoing research.

According to HTH, diseases involving micro-hair shafts derived from basal cell carcinoma are not caused by cell anomalies but by the accumulation of hair follicles and exposure to continuous mechanical stress. In my own disease, I showed that the hair follicles fold into the eyelids and form secondary nodes. The geometry of this structure is a torus.   ecause there are no hair follicles between the two eyelids.

Upon clearance of the affected area, a reestablishment of normal anatomical contours was noted. Notably, the previously observed twitching of the left eyebrow— triggered by specific positioning of the left arm—did not recur. These outcomes suggest that the underlying structure exhibited greater biomechanical complexity and resilience than initially assumed.

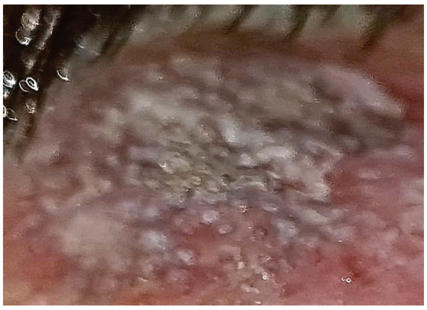


Figure A5: Close-up view of the structure formed by hair follicles

Figure A6: In the final state achieved after the area's clearance, the regrowth of hair was observed in the left preauricular region

Following the aforementioned topical treatments—and after a period marked by depressive affect—subsequent observations suggested that the primary pathology may not have been localized within the initially targeted region. This prompted a renewed investigation using the same methodological approach. Although the reduction in hair density in the left frontal region had likely developed

gradually over time, it became particularly noticeable at this stage. This finding was accompanied by a band-like recession of the hairline, consistent with the clinical presentation of Frontal Fibrosing Alopecia (FFA) (Figure B1–B2).

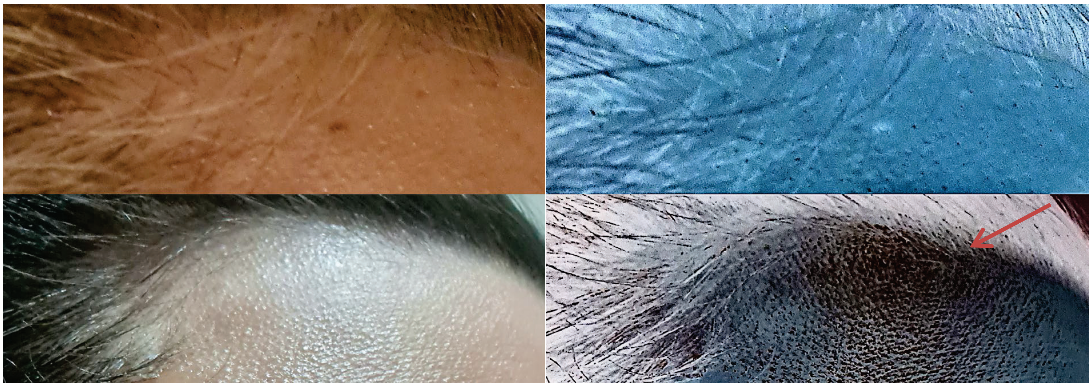


Figure: B1- B2 Observation of the region across different time points.

Upon further detailed examination, it was determined that the direction of the observed traction was opposite to that noted in previous assessments. In this region, physical palpation revealed localized thickening, accompanied by an asymmetrical reduction in hair density when compared to the contralateral side (Figures C1–C2).

Figure C1 - C2 The patterns appear vaguely because the tension is at its limit.

In the region where the primary hair whorl was located (Figures C1–C2), the presence of a congenital nevus was also noted. A second hair whorl was identified in the posterior parallel of the same area; however, it was considered that the hair growth pattern in that region had normalized with age. Subsequently, the presence of micro-folds was detected.

The nevus and its underlying tissue, as visualized in Figures C1–C2, exhibited a distinctly stratified and rigid structure in comparison to the surrounding tissue. Hair follicles in this area appeared abnormally stiff and compressed during traction applied to individual strands, deviating from expected biomechanical resistance. The tissue was assessed as devitalized.

No overt pathological changes were observed apart from the aforementioned hair loss and pattern formations. However, the marked firmness detected during palpation and the degree of skin retraction suggested the presence of an inter-layer topological alteration. In light of these findings, a basic level of computer-assisted dermoscopic analysis was initiated(Figures C1–C2).

The structural configuration of the region revealed that each fold area corresponded to fibrotic tissue arranged in a spiral pattern. The extraction of individual hair strands led to a sudden and localized release of tension within the surrounding microscopic fibrous tissue.

"Three-dimensional rendering of a trefoil knot"

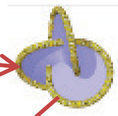


Figure from: Sommer, M. (2007). Visualization in geometric knot theory (Diploma thesis, Technische Universität Berlin). https://page.mi.fu-berlin.de/johnsoma/diplom.pdf

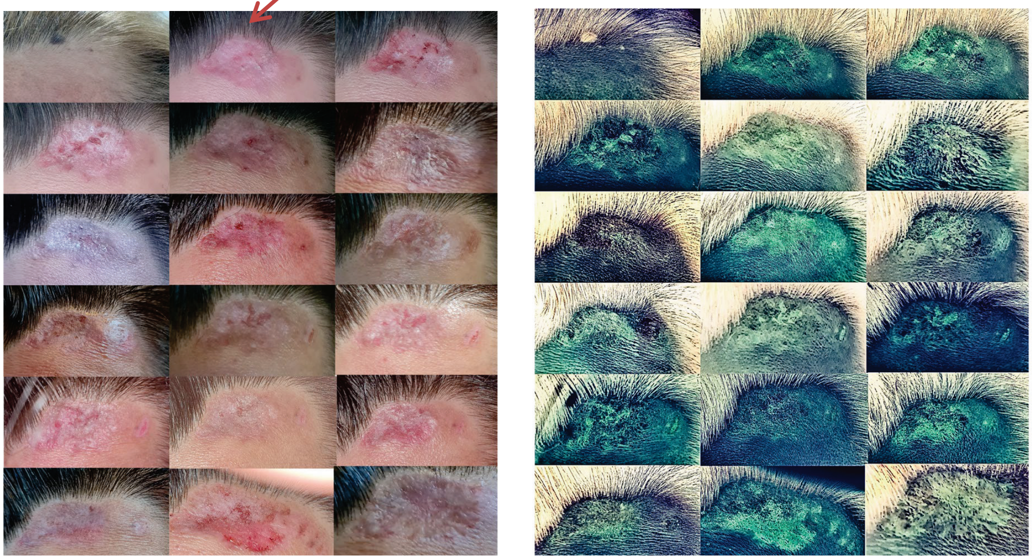


Figure D1: Clockwise changes following application. Layers are more readily analyzed in the negative image

A micro-fibrous tissue mass—approximately equivalent in volume to that of a mandarin orange—was excised from the delineated region (Figure D1, extending to the rightmost frame).

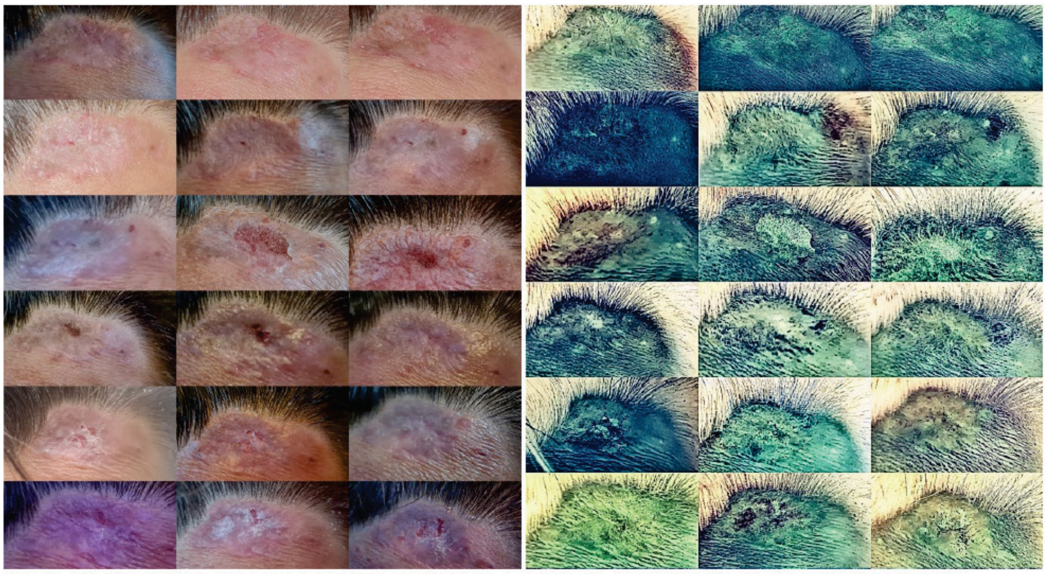


Figure E1: Clockwise changes following application. Layers are more readily analyzed in the negative image.

Although significant effort was made to maintain chronological consistency, some discrepancies in visual sequencing may be present due to the long-term and evolving nature of the process starting in 2020, as well as the unplanned initiation of this publication.

At a particular stage in the clinical course (Figure E1), it was considered that seeking professional medical consultation might contribute to greater diagnostic and therapeutic clarity.

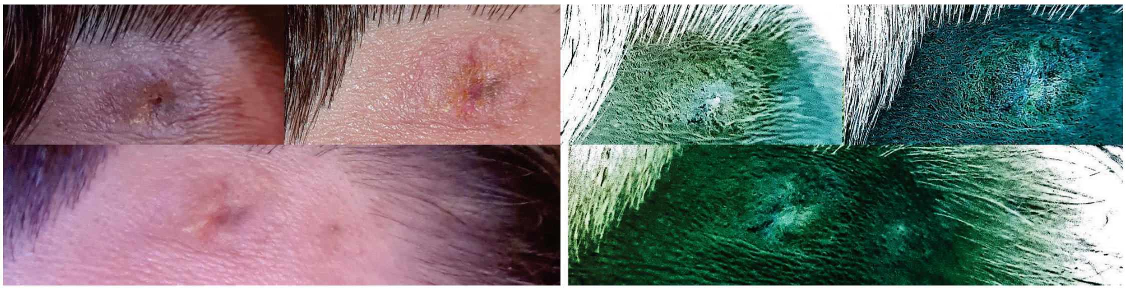


Figure F1 - Images taken on different days of the final state before the tissue sample was surgically excised. You can observe the patterns again in the negative version

Consequently, a follow-up consultation with a physician was undertaken. Subjective symptom relief was noted, accompanied by relaxation in the affected region and pore dilation around the periorbital and nasal areas. Additionally, retrograde-oriented microscopic hairs were observed emerging from the lacrimal region.

An excisional biopsy was performed by the attending physician in the specified area, and the incision was closed with sutures. Although the necessity of suturing was questioned—due to the presumed presence of a topological knot in the underlying tissue—the procedure was completed as planned. On the day of the operation, the sutures were removed in a self-administered yet controlled manner. Visual documentation of this process is provided. The histopathological findings were reported as follows: “Examination of the entire specimen revealed acanthotic stratified squamous epithelium with surface hyperkeratosis. Aside from mononuclear cell infiltration in the papillary dermis and periadnexal regions, no additional pathological features were identified.”

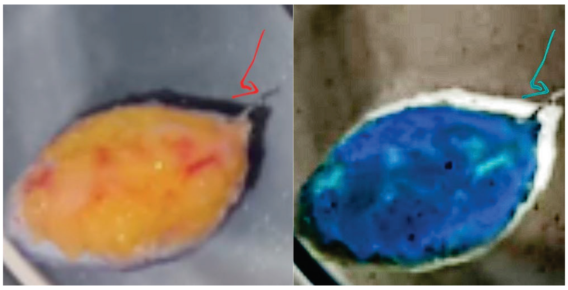


Figure G1 Biopsy Specimen

Doku Alınan Yer	:
Doku Alınma Şekli	: EKSIZYONEL BIOPSI - AMELIYAT MATERYALI
Klinik Bilgi	
KLİNİK TANILAR	L73.2 Hidradenitis Supurativa
MAKROSKOPİ	Patoloji no: 0011-23 Üzerinde 1.2x0.8 cm boyutta deri elipsi bulunduran, 1.2x0.8x0.6 cm boyutlarda deri eksizyonel biyopsi materyali. TTA 2P1K
UYGULANAN ÖZEL YÖNTEMLER (Özel boyalar,IHK,moleküler yöntemler,EM) -Özel Histokimyasal Boyalar -İmmünohistokimyasal İnceleme	
TANI(ICD-O Kodları)	- SAĞ FRONTAL BÖLGE DERİ EKSİZYONEL BİYOPSİ; LÜTFEN YORUMU OKUYUNUZ
TIBBİ LABORATUVAR YORUM	Tamamı incelen örneklerde yüzeyde hiperkeratoz gösteren akantotik çok katlı yassı epitel izlenmiştir. Papiller dermada ve deri ekleri çevresinde mononükleer hücre infiltrasyonu dışında bulgu saptanmamıştır.
Açıklama(NOT)	

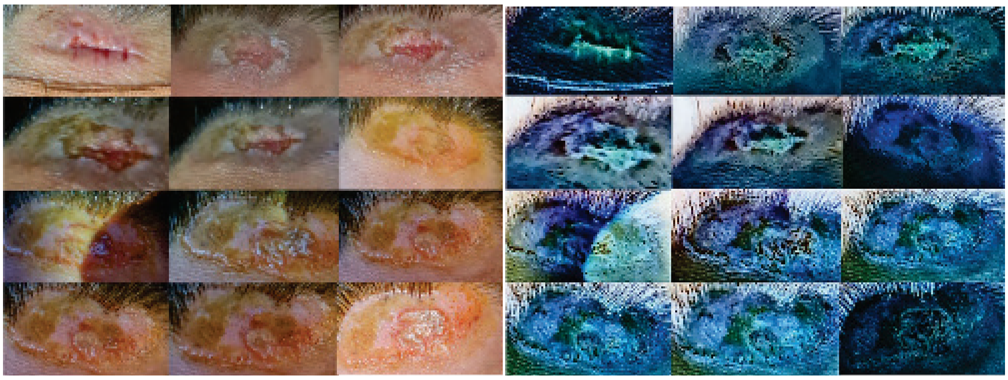


*Figure H1, the postoperative suturing status is observed in the initial image. As the series progresses, a turbulent appearance is observed to emerge in the superficial layer of the structure in the images between H1*2 and H1-5*

The unfolding of micro-spiral loops and the structural behavior of epidermal micro- folds are actively being observed. In effect, the epidermis appears to have formed a self- infolded configuration, likely influenced by the presence of the aforementioned topological knot. As a result, the underlying cause of the observed turbulent structural pattern becomes more comprehensible—its geometry likely resembling a turbulence model, potentially shaped by the angular configuration of the underlying bone structures.

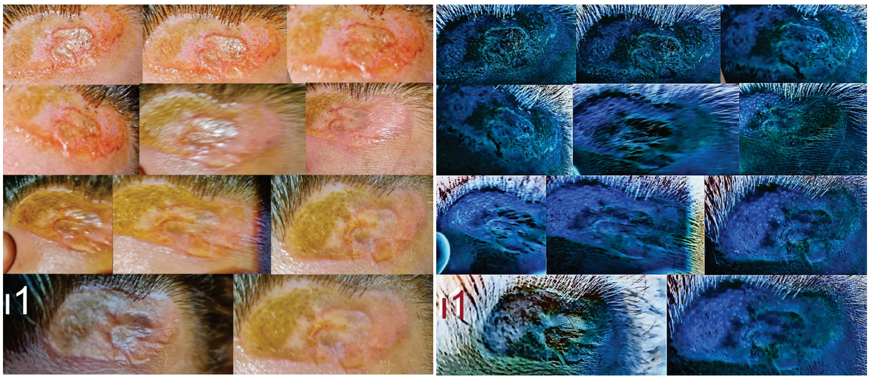


Figure I1 It is believed that the structure presented in can be better perceived when examined from a broader perspective. Original image and video recordings are available; however, their complete inclusion in this documentation was not feasible for practical reasons.

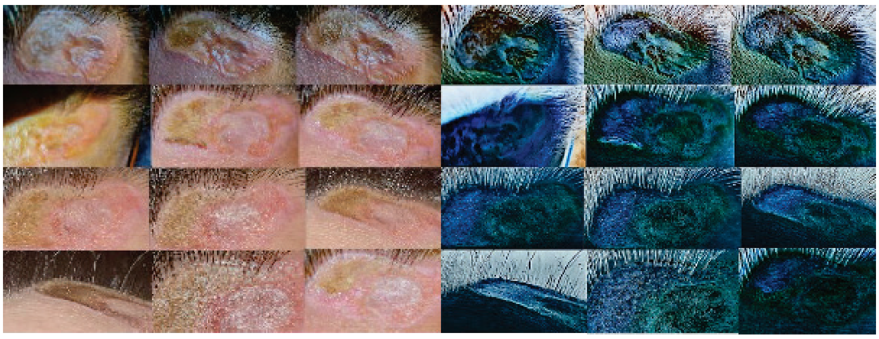


Figure J1 - This will provide information regarding how the process progressed.

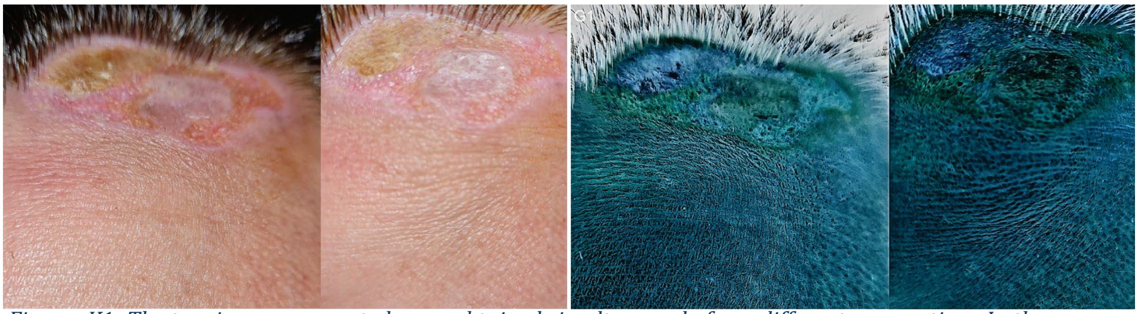
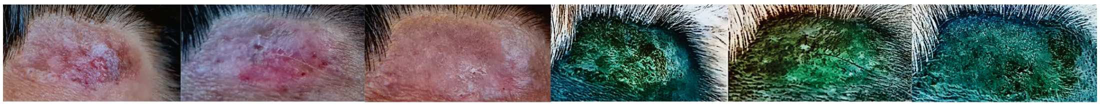


Figure K1: The two images presented were obtained simultaneously from different perspectives. In these images, the skin can be observed to be microscopically folded upon itself. The right-side K1 image was recorded during the contraction of the frontal muscles



L1 L1

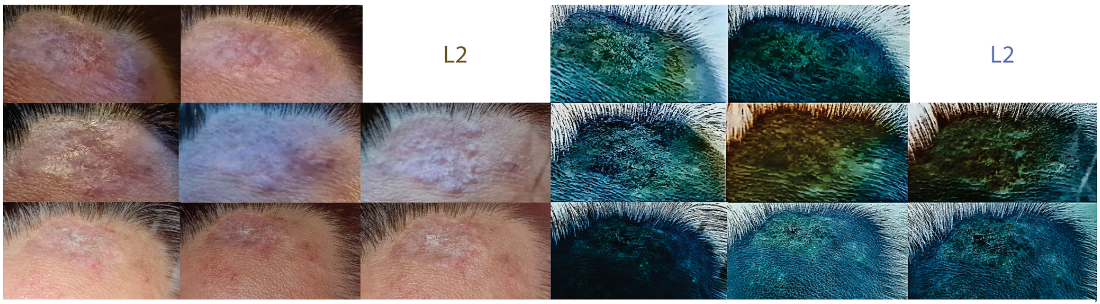


Figure L2 Epidermal layers subsequent to L2.

Figure 1Figure K2: Dermatoscopic image - Resembles a biopsy section.

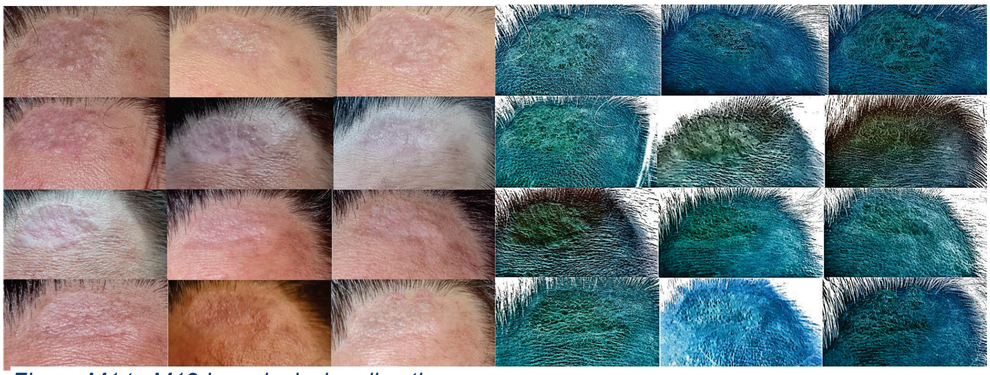
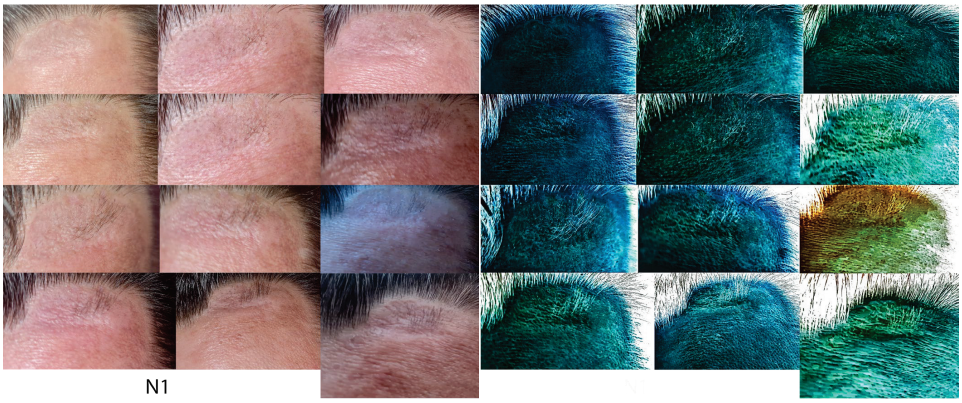


Figure M1 to M12 In a clockwise direction



Following the interventions, the frequent emergence of self-invaginated epidermal configurations was observed. This phenomenon supports the notion that the epidermis can form microscopic infoldings that also extend into the superficial layers of the dermis.

A range of structural changes was identified extending beyond the initially targeted area, involving the upper limbs, cervical region, periorbital areas, and the face. Notably, cutaneous fissures developed along the flexural surfaces of the elbows in the upper extremities.

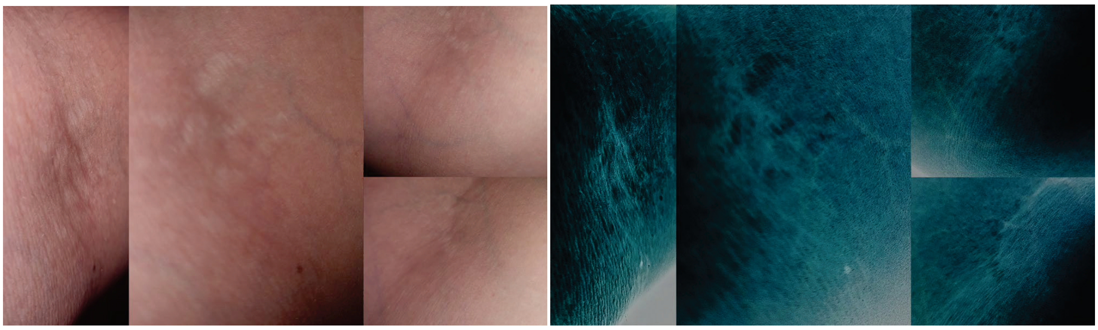


Figure O1You can see how a harmonious crack forms in a symmetrical structure.

Figure O1. The degree of concordance between the pattern in the frontal region and the observed configuration can be evaluated. The presence of cutaneous fissures reflects the magnitude of mechanical strain experienced in the area. As this outcome was unexpected, only the subsequent image is available for documentation.

Figure P1 Evidence of early-stage hair regrowth is observed in the contralateral frontal region. The emergence of newly oriented fine terminal hairs along natural skin tension lines coincides with a visibly relaxed dermal surface.

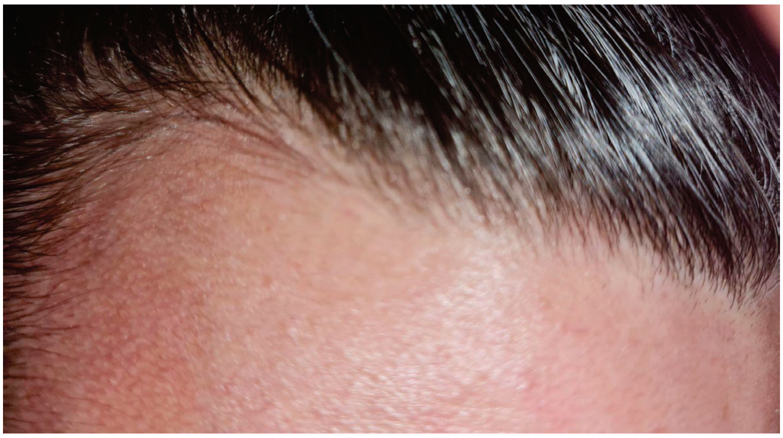


Figure P2 Subsequent condition shows further thickening and alignment of the regrown hairs, with normalization of skin texture. The combined visual progression supports the hypothesis that mechanical release and topological rearrangement may facilitate

Figure P2 The anterior mid-frontal hairline

The anterior mid-frontal hairline region demonstrates the presence of knotted vellus hairs and miniature hair fibers. These structures appear to be entangled and misaligned, potentially reflecting localized dermal tension and micro-topological distortion. The pattern may also suggest early-stage follicular reactivation occurring under structural constraint.

Figure AS-1 Dermatological patterns not discernible to the naked eye are visualized through the application of contrast- enhancing filters. Multiple linear and spiral markings (A2–A8) are observed, especially in the clavicular and suprasternal regions. While these lines bear resemblance to classical dermal tension lines such as Langer's lines, their location and orientation deviate from standard anatomical maps. This discrepancy supports the hypothesis that topologically induced mechanical strain may generate secondary or acquired tension patterns over time.

Notably, the observed patterns appear in regions devoid of joint articulation, which typically serve as focal points for tension-related dermal lines. This supports the hypothesis that the detected markings may be secondary structures resulting from accumulated mechanical strain rather than inherent anatomical motion.

It was determined that the striations in the cervical region, initially localized at the A7 anatomical point, migrated towards the inferior of the zygomatic bones as the process progressed.

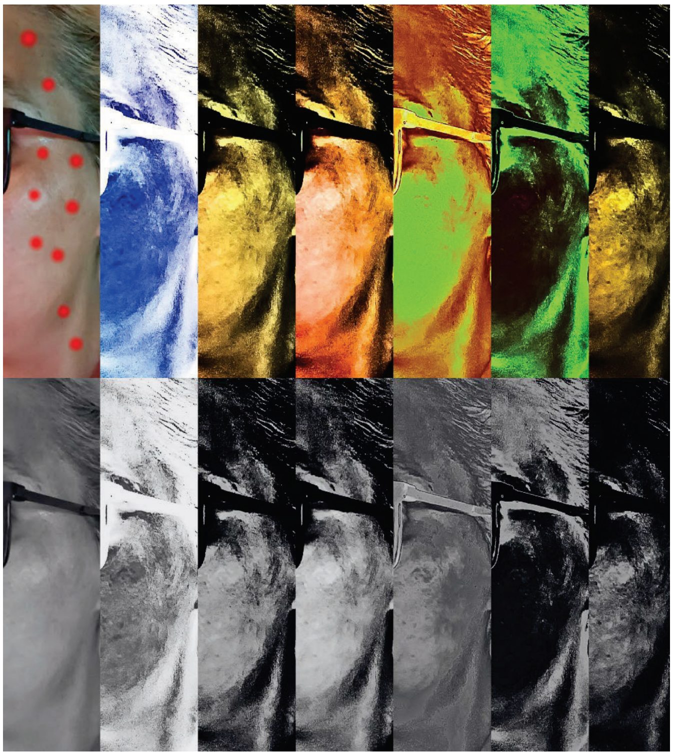


Figure T1

Figure T1 - The emergence of new eyelashes induces skin folds in the affected areas due to continuous epidermal traction and the presence of concave and convex regions. This traction propagates to the underlying bone tissue, causing the emerging hair in these areas to fold back upon itself, particularly in regions involving hard tissue such as bone. The fold between theb zygomatic bone and the periorbital area is clearly visible. Rosacea lesions are present along the edges of the nose and in a parallel region directly beneath the applied traction in T1. As the skin folds upon itself in these areas, capillaries become visible where the tension is most intense. The same pattern of fold-induced vascular changes is observed in the nose and surrounding regions, further reinforcing the cyclical process of skin deformation and inflammation.

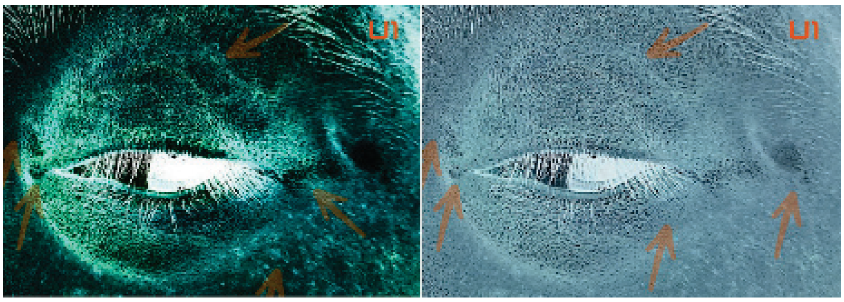


Figure U 1

Figure U1: Basal cell carcinoma pattern resulting from the tension of the stretched epidermis. As the areas relax, numerous minute yet robust hair foci emerge from these regions. These foci exhibit a hollow center with interlocked edges, as geometrically, the space between the two eyelids is a point where hair follicles do not typically emerge, thus creating a void.

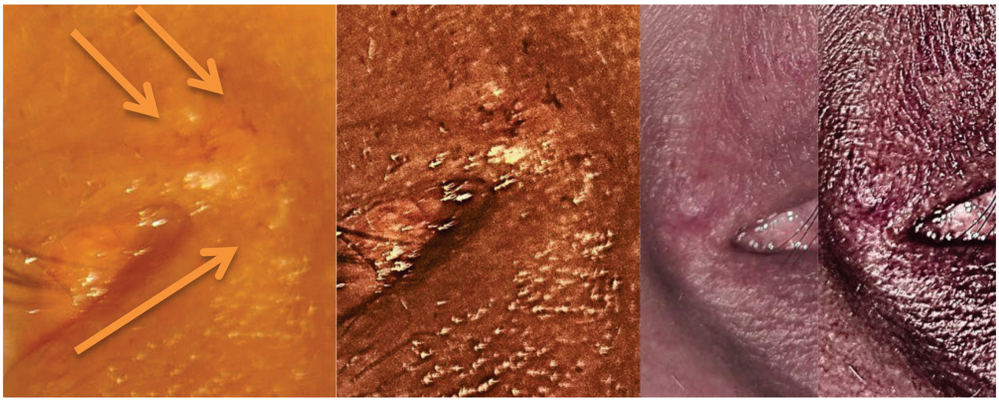


Figure U2 Orange arrows is a folding area.

The images (U2) demonstrate the emergence of mini hair follicles, marked by arrows. Upon relaxation of the affected area, these follicles, which were previously compressed due to mechanical strain, begin to emerge in the reverse direction. This process is triggered by the reduction in tension, and minimal stimulation with glycolic acid serum facilitates their return to their original position, following the same pattern observed during initial relaxation.

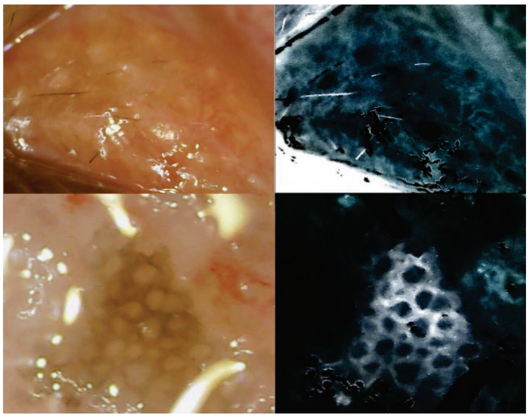


Figure R1: Lacrimal Gland. The white structures remain internally inverted.

Figure R2: Focal structures identified in the zygomatic region, initially observed to be interlocked and subsequently released.

Figure 7 S1

Figure S1: Final state of the expansion in the region. The image illustrates the ongoing process, where hair has emerged from follicles as the topological knot is progressively released. The honeycomb-like pattern surrounding the skin highlights the areas of tension, showing the extent of skin deformation as the underlying structure continues to unfold. This process indicates that the follicular release and structural changes are still in progress

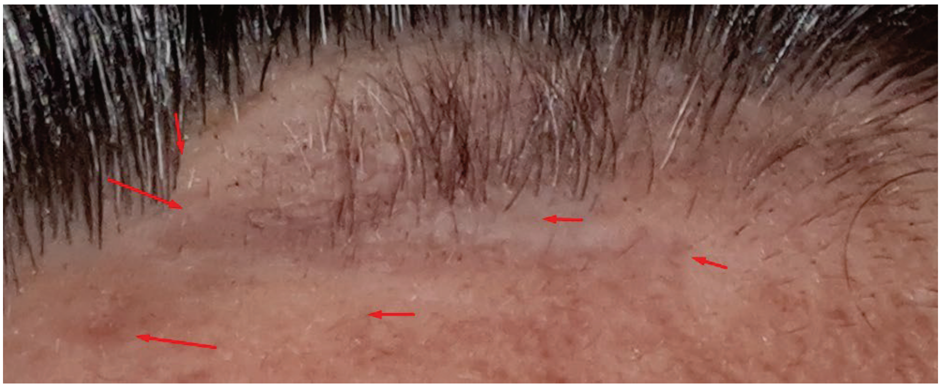


Figure T1: The region can be observed to be folding and retracting upon itself, resulting in epidermal slippage. The red arrows highlight areas where the mechanical tension is most prominent, leading to skin deformation. This phenomenon reflects the ongoing **structural impact** of tension on the epidermis, causing it to shift and form visible folds. The **epidermal slippage** indicates the displacement of skin layers, which occurs as the pressure is released, resulting in the unfolding and relaxation of the tissue. Additionally, areas where **bone tissue** exerts influence on the skin's structure can be observed, providing further insight into the mechanical forces at play. (Below are the new pictures, this is the old version and the note from that time)

Last Observations:

Figure S2 On 07 May 2025

Figure S3 On 11 May 2025

Figure S4 On 26 May 2025 : after each application, the skin tone becomes slightly redder.

Figure S5 As the topological knot on the right side is untied, the patterns of the invisible attractors begin to become apparent. The red arrows show the patterns, and the green arrow shows the direction of the attractor. On 27 April 2025

Figure S6 2025 05 31_19:00

Figure S7 2025 05 31_19:36

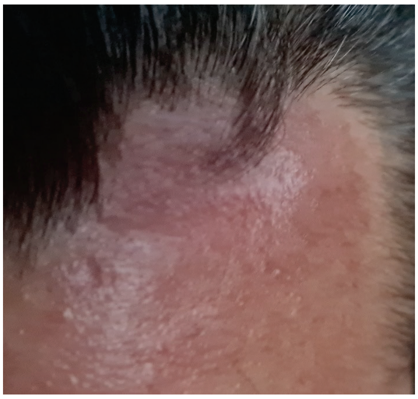


Figure S7

2025 05 31_19:46

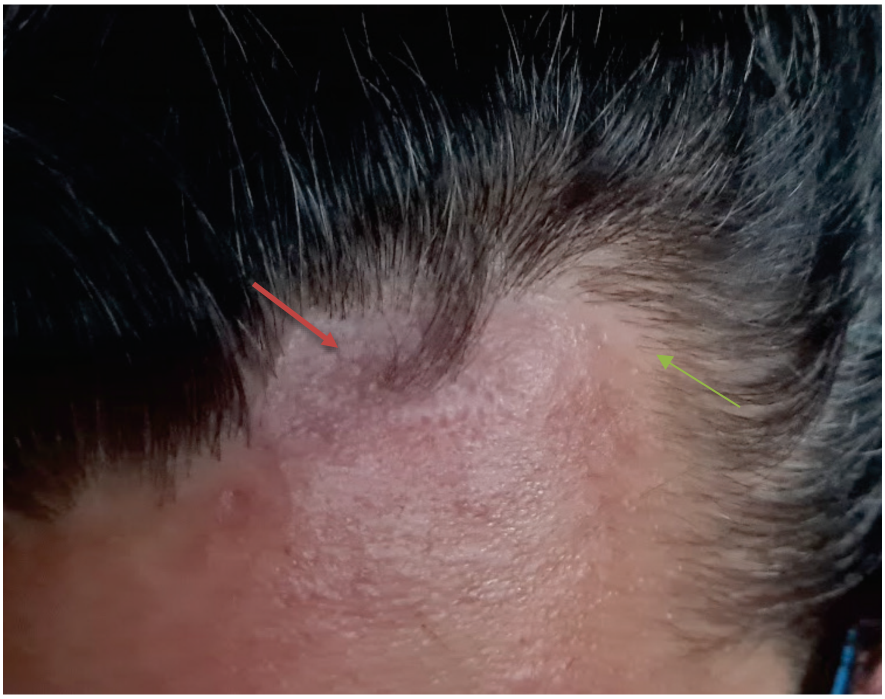
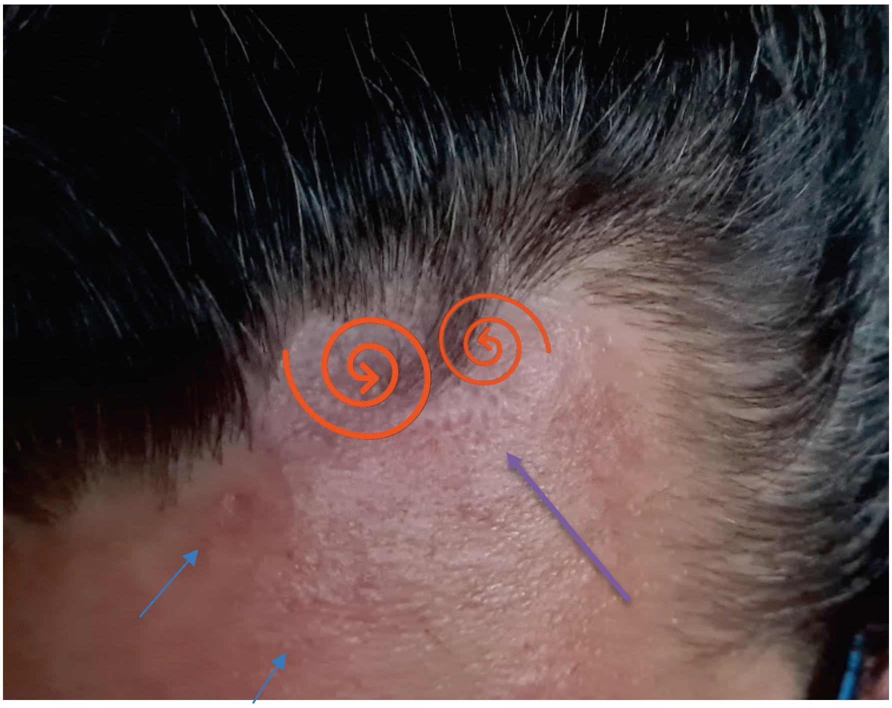


Figure S8 2025 05 31_19:46

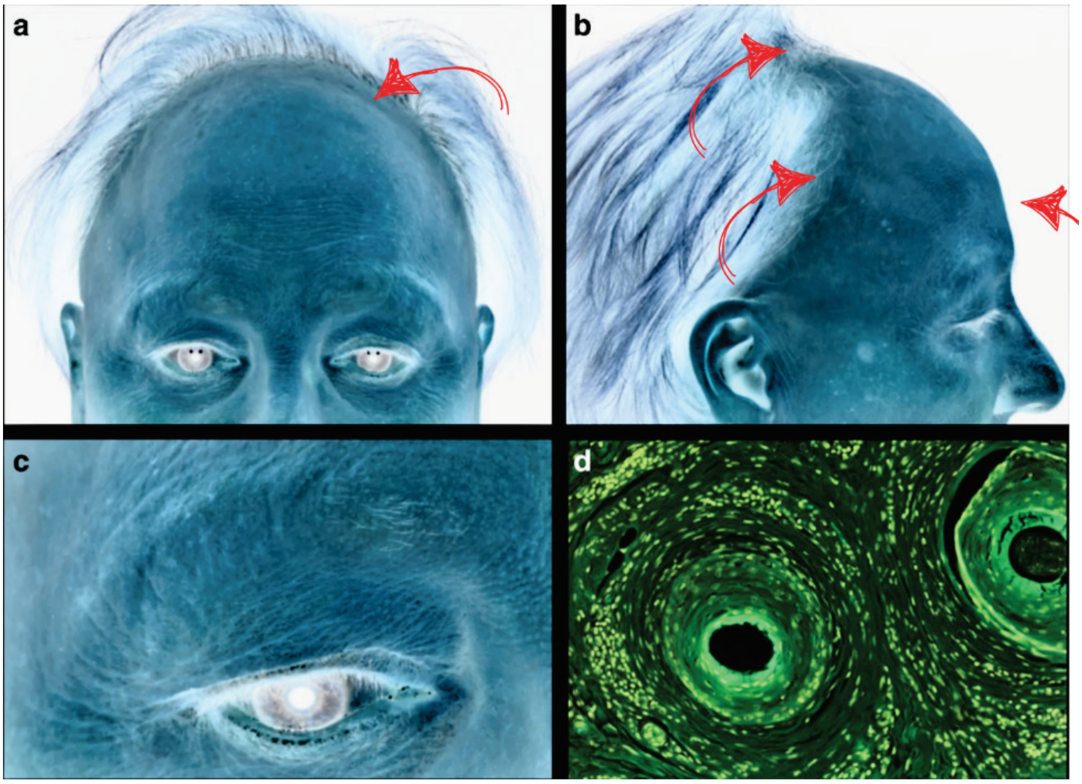


The spiral arrows indicate the directions of microfolds. Under normal circumstances, tissues that are not usually close to each other come closer together as the total mechanical force of the topological knot strengthens over time, essentially causing the region to "stitch" together. The purple arrow represents the intersection point of two different areas; even when the microfolds open up, their shapes remain the same for a while due to permanent deformation.

The blue arrows indicate two symmetrical parts. This is because the folds in that region have opened up. Normally, the pattern above was not visible because it was very tense.

iterature examples

Adapted by: By Sydney S. Gellis and Murray Feingold - Atlas of mental retardation syndromes; visual diagnosis of facies and physical findings, Public Domain, https://commons.wikimedia.org/w/index



Adapted by: Uploaded a work by Nature Communications from Tziotzios, C., Petridis, C., Dand, N. et al. Genome-wide association study in frontal fibrosing alopecia identifies four susceptibility loci including HLA-B*07:02. Nat Commun 10, 1150 (2019). https://doi.org/10.1038/s41467-019-09117-w https://www.nature.com/articles/s41467-019-09117-w/figures/1 with UploadWizard

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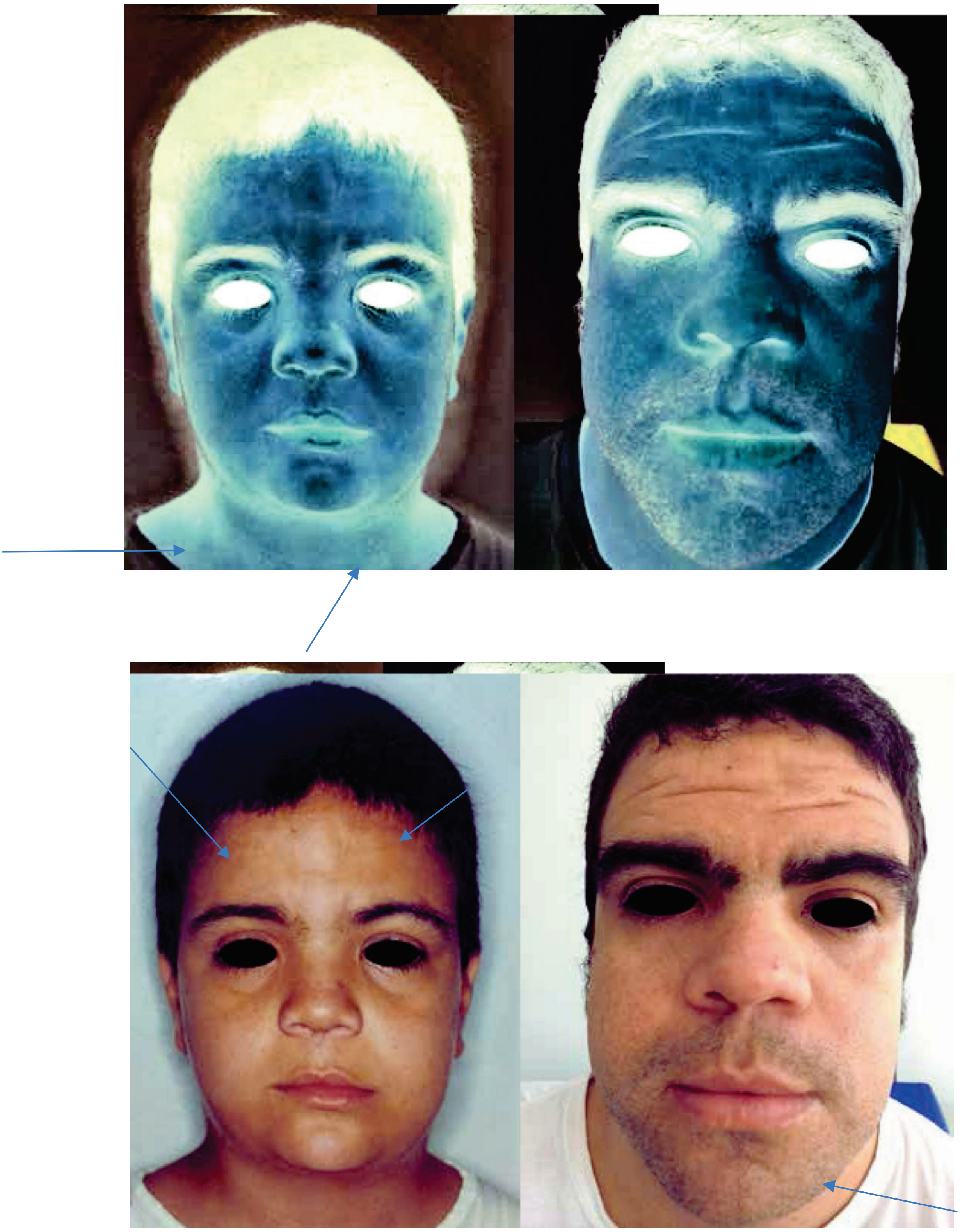

Adapted by Syndrome in question • An. Bras. Dermatol. 91 (4) • Jul-Aug 2016 • https://doi.org/10.1590/abd1806-4841.20164428

The Human Topological Hypothesis (HTH): Scientific and Historical Foundations

This section provides the background and rationale for the Human Topological Hypothesis (HTH) proposed in this article. The Human Topological Hypothesis (HTH), as presented here, is an original and independent theoretical framework.

Perspectives on Hair Whorls and The Mechanical Theory

A broad body of literature—from embryological observations (Voigt, 1857; Landauer, 1925; Kiil, 1949), through pediatric anatomy and dermatology studies (Smith & Gong, 1973, 1974; Wunderlich & Heerema, 1975; Findlay & Harris, 1977; Samlaska et al., 1989), to clinical-surgical classifications (Ziering & Krenitsky, 2003) and modern genomic validations (Luo et al., 2023)—consistently demonstrates that hair whorls are not merely superficial spirals but constitute a multi-layered flow field, woven from oppositely oriented vectors extending from the epidermis to the reticular dermis.

Voigt (1857) provided detailed observations of the hair streams on the frontal region of the scalp, noting that they emerge from the main whorl at the vertex and orient toward the inner corners of the eyes, with frontal patterns arising from the interaction of distinct growth vectors. These mechanophysical flow patterns are further supported by Kiil's (1949) findings on the competition between growth vectors and the existence of collision zones in cutaneous flows.

Smith and Gong (1974) proposed that the oblique alignment of hair follicles is determined by the relative growth tension formed across the epidermis as the follicles grow downward, and that the dome-like expansion of the brain modifies the lateral growth tension in the outer layers. Additionally, the formation of a fixed point at the whorl's center can be explained by the fixed-point theorem: while all points on a disk or dome-like surface move outward, there exists a single point at the center that remains stationary. These observations parallel Voigt's (1857) earlier descriptions of hair orientation. Landauer (1925) emphasized that hair inclination primarily results from mechanophysical forces, with the skin playing a passive role.

Overall, hair orientation (vector field) and its singularities—namely whorls and intersections—are, across the literature, predominantly linked to mechanical and physical forces. Voigt, Landauer, and Kiil argue that the orientation of hair and the emergence of whorls are shaped by mechanical tensions and forces arising from the growth laws of the skin and underlying tissues. Landauer also defined whorls as points where tension forces from different directions meet, and referenced Bosch's classical experiment, in which pins placed on a stretched rubber sheet remain upright at the point where tension is balanced—mirroring the upright orientation of hairs at whorl centers. It has also been proposed that muscle-generated tension applied to the skin may be related to the formation of whorls.

According to the mechanical theory, hair whorls are not merely superficial patterns; rather, they function as multilayered and topologically stable centers of organization that extend through both the epidermis and the deeper layers of the dermis. These structures, shaped by mechanical tensions and growth vectors, provide both the structural integrity and the functional resilience of the biological tissue. Consequently, it can be inferred that the inclination and orientation of hair follicles are determined predominantly by environmental and mechanical forces rather than genetics; thus, they are to be considered within the framework of the "mechanical hypothesis."

In general, the human body's surface geometry—characterized by concave and convex forms but lacking sharp edges—enables effective camouflage. Morphological continuity allows such topological organizations to function invisibly and to integrate with the overall system without causing overt distortions on the surface.

Mechanical Strength of Human Hair

Sharma et al. (2017) demonstrated that adding 2% human hair to concrete mixtures can increase the compressive strength of M20-grade concrete by approximately 8.7% after 28 days. Yang et al. (2020) reported that individual human hair fibers exhibit a tensile strength in the range of 200–260 MPa and an elongation at break exceeding 40%. Additionally, the specific strength of human hair is comparable to that of many metal alloys. Based on theoretical calculations, it has been suggested that several hundred hair strands could collectively support the weight of a human, although this remains to be validated experimentally (Yang et al., 2020).

The findings indicate that the high tensile strength and elasticity of human hair support both the structural integrity and dynamic stability of the multilayered spiral organization present in the scalp.

The Hairy Ball Theorem

The Hairy Ball Theorem mathematically demonstrates that any continuous tangent vector field defined on a sphere must have at least one point where the vector field vanishes (Milnor, 1997). In other words, it is impossible to “comb” all the hairs (vectors) on a spherical surface smoothly; there will always be at least one vortex or singularity. This topological necessity is more generally expressed by the Poincaré-Hopf theorem, which states that for any differentiable manifold, the sum of the indices of all singularities of a vector field must be equal to the Euler characteristic of that surface (Milnor, 1997; Frankel, 2012). For example, since the uler characteristic of a sphere is 2, there must necessarily be singularities (such as whorls or vortex points) in the vector field—such as on a biological surface like the scalp—whose total indices sum to two (Frankel, 2012). Thus, the Hairy Ball Theorem, the Poincaré-Hopf theorem, and the Euler characteristic together explain that the appearance of whorls and vortices on biological surfaces is a topological inevitability.

In the literature, it is clearly stated that hair whorls in both humans and animals produce distinct orientations and spiral patterns, with these structures manifesting as topological singularities on the surface (Voigt, 1857; Findlay and Harris, 1977; Smith and Gong, 1973, 1974; Landauer, 1925; Kiil, 1949). The fundamental role of growth tension and topological constraints in the formation of these vortices has been emphasized. Especially through analyses inspired by the methods of mathematicians such as Euler and Poincaré, it has been shown that fixed points and singularities are unavoidable on such surfaces (Findlay and Harris, 1977).

Logarithmic Structure of Hair Whorls

Voigt (1857) strongly argued that the spiral pattern observed in hair whorls can be mathematically reduced to a logarithmic spiral model, applying the laws of phyllotaxis (leaf arrangement) in plants to human anatomy. He noted that mathematical characteristics of the logarithmic spiral—such as its constant angle and the fact that it never truly reaches the center—were consistent with his own observations. Voigt's model was supported by measurements and geometric comparisons, suggesting that logarithmic spiral structures can be observed in biological tissues.

On the other hand, studies by Findlay and Harris (1977), Smith and Gong (1973, 1974), Landauer (1925), and Kiil (1949) focused less on verifying a specific mathematical spiral form (such as the logarithmic spiral) in hair whorls, and more on the importance of growth tension, tissue development, and topological constraints. These sources do not explicitly reject Voigt's logarithmic spiral model; however, based on their data and analyses, they neither confirm nor refute that the spiral exactly matches classical mathematical models.

In summary, there is consensus in the literature regarding the existence of central spiral structures and topological singularities in hair whorl regions. While Voigt strongly advocated for modeling the spiral pattern as a logarithmic spiral, other studies have not directly addressed this model, focusing instead on formation mechanisms and topological necessities. Therefore, whether the spiral structure in whorl areas strictly conforms to classical mathematical spiral models (logarithmic, Archimedean, Fibonacci, etc.) remains an open question in the literature.

To rigorously assess whether the spiral structure in the whorl region truly exhibits a logarithmic form, one must examine the arrangement and spacing of hair follicles across the surface. If the hair follicles are positioned at regular intervals along the spiral—arising as a result of topological necessity—then it is reasonable to propose that this pattern approximates a logarithmic spiral. Characteristically, a logarithmic spiral maintains a constant angle and proportional spacing between successive turns; when follicle intervals are uniform, the system achieves minimal energy and optimal tension distribution. Therefore, as the regularity of follicular spacing and arrangement in the whorl area increases, the likelihood that the spiral structure converges toward a logarithmic model is strengthened. However, current evidence does not definitively prove that the spiral form is strictly logarithmic; thus, the observed pattern's proximity to a logarithmic structure should be considered a probabilistic and structural interpretation rather than an absolute fact.

Distance Between Hair Follicles

According to the literature, the distance and density between hair follicles vary both between individuals and across different regions of the scalp; however, in most cases, follicles tend to cluster around a specific mean value and form a relatively regular pattern (Jimenez & Ruifernández, 1999). Quantitative findings indicate that the distance between hair follicles typically ranges from 1.0 to 1.4 mm, and although density varies by anatomical region, it remains statistically constrained within a certain interval. Moreover, the regularity in follicle spacing and distribution has been experimentally shown to be governed by a reaction-diffusion–based developmental mechanism involving molecules such as WNT and DKK (Sick et al., 2006).

Thus, although there are mathematical variations between individuals and across different regions, hair follicles are arranged on the surface at approximately equal intervals—with differences that are mathematically negligible. This regularity supports the existence of a logarithmic whorl structure observed in the scalp. Furthermore, when the high tensile strength of hair shafts and the mechanical organization of layered follicles within the dermis are also taken into account, it can be asserted that this region exhibits a multilayered and topologically logarithmic structure.

Moreover, the literature emphasizes that hair formation is influenced by underlying biological structures—such as papillae, nerve tubes, and blood vessels—as well as by the laws of growth and tension operating within the different layers of the skin (Voigt, 1857; Landauer, 1925). The concept that hair follicles are arranged in regular patterns within the dermis, specifically as "equidistantly positioned spirals," supports the view that the hair pattern is not only a surface phenomenon but also represents a multilayered organization extending in depth (Voigt, 1857; Landauer, 1925).

The Skin as an Active Responder

When the skin is subjected to tension, collagen fibers become straightened and align in the direction of the applied force. At high strain levels, these fibers are thought to slide relative to one another. Analyses have shown that under strain, collagen fibers first align within their own fiber families, and then these families collectively orient themselves in the overall direction of the force. The maximum alignment of the collagen network is determined by the highest level of strain applied (Witte et al., 2021). These findings demonstrate that collagen fibers can reorganize under mechanical load and that the tissue exhibits a dynamic response at the microstructural level.

The mechanical behavior of human skin is direction-dependent, a property known as biomechanical anisotropy. Langer's lines represent these orientation-based differences and indicate that the skin’s tensile response is more resistant along certain axes (Liang & Boppart, 2010).

Structure of the Forehead Region and Anatomical Continuity of Tissues

According to Otberg et al. (2004), although the forehead region possesses some of the smallest average follicular diameters (66 m), it has the highest percentage of follicular openings on the skin surface (1.28%) due to its high hair follicle density (292 follicles/cm^2). The same study reported that the volume of follicular infundibulum is 0.19 mm^3/cm^2, which is comparable in density to the upper layer of the stratum corneum (p. 17).

Anatomically, the fasciae and tissue layers of the forehead and temple regions are not independent structures but are instead defined as a connected system that exhibits continuity between them (Ingallina et al., 2022). This continuity is maintained by the uninterrupted extension of the five-layered structure of the scalp into the forehead and temple areas. In particular, the layers of skin, superficial fat, loose areolar tissue, and periosteum exhibit structural integrity in these regions (Ingallina et al., 2022).

These findings suggest that the forehead region should be evaluated not only in terms of hair density but also as a potential biomechanical reservoir. The high percentage of follicular openings may render this area critical for surface diffusion, tissue renewal, and the transmission of vectorial forces. Furthermore, the anatomical continuity between the forehead and temporal regions allows topological tensions and spiral patterns to be more effectively organized within these zones. These characteristics may indicate that the orientation of hair follicles responds not only to local but also to systemic tension flows.

The Newly Described Interstitial Structure in 2018

The interstitial structure described in 2018 introduced a conceptual shift that significantly challenged the classical understanding of connective tissue. It was demonstrated that, in areas previously thought to be compact and dense, there exist fluid-filled spaces surrounded by collagen bundles, and that these spaces can form a continuous network throughout the tissue (Benias et al., 2018). These spaces are thought to be not only structural but also biologically active. In particular, the presence of CD34- and vimentin-positive cells on the surface of collagen bundles suggests that this region is functionally significant in terms of cellular interactions.

Proteolytic remodeling of the extracellular matrix (ECM) within these peripheral microspaces not only alters tissue architecture but also affects the release of growth factors, thereby playing a decisive role in processes such as cell proliferation, differentiation, and migration (Bonnans et al., 2014). Furthermore, these structures may provide a microenvironment that facilitates the spread of certain tumor types even in the absence of a direct connection with the lymphatic system. Indeed, the observation of T2-stage tumors capable of metastasizing without evidence of lymphatic invasion in the study by Benias et al.

suggests that interstitial spaces may serve as an alternative route for dissemination (Benias et al., 2018).

Considering these new findings, chaos that may arise under the limited analytic continuity potentially created by hair whorls could mechanically induce or contribute to various diseases. The formation of turbulence-like structures or the migration of tumors observed in certain pathological conditions may be explained by such a mechanism.

Dynamic Fields Around Hair Whorls and Growth-Induced Topological Knot Formation

In mathematics, knot theory concerns the study of closed curves in three-dimensional space and the possible deformations of these curves without cutting or passing through themselves (Osserman R2024).

Human growth is not limited to the fetal stage but continues rapidly thereafter. The dynamic regions surrounding hair whorls—characterized by strong hair shafts, the elasticity and deformability of the skin, and the expansion of the skull and body—can cause the constants within these whorls (topological invariant = knot invariant = constants of the hair whorls) to transform into topological knots. This transformation can occur because the whorl area is constantly subjected to micro and multi-angle forces. Furthermore, when the multi-layered nature of this formation is considered, it can evolve into the simplest knot, the trefoil knot, potentially due to how it interacts with and reflects forces from the surrounding limited elastic tissue. This concept may seem rather abstract at the moment, but it will be illustrated with visual aids. After analyzing projections, it becomes clear that the particular knot observed in my case is a trefoil knot. The underlying structure of various topological knots may also explain the origins of terms used for different types of alopecia, such as "triangular alopecia" or "patch alopecia."

Response to Topological Invariants

The invariance in the number of hair curvatures (primary whorls) and vortices demonstrates that these topological structures in the skin exhibit resistance to mechanical stresses. However, this does not mean that these structures are completely non-interactive. To elaborate: topological invariants in the skin—such as whorls and vortices—remain numerically constant even when subjected to external forces. This is a significant property from the perspective of mathematical topology. However, this “invariance” should not be mistaken for simple immobility; rather, it represents a complex mechanism of resistance.

Force Distribution and Reflection Mechanism of Topological Knots

Topological invariants in the skin—such as hair whorls and vortices—tend to reflect, rather than directly absorb, incoming mechanical forces. This behavior is closely related to the viscoelastic properties of the skin. The mechanism operates as follows:

$$\sigma(t) = E\epsilon(t) + \eta\frac{d\epsilon(t)}{dt}$$

$E = E(n)$ Here, **n** denotes a direction vector.

$$E^{Start} \rightarrow E^{Adapted} \quad generally\ E^{Adapted} > E^{old}$$

Rigid topological structures—such as whorl centers—reflect incoming forces directly. Owing to the elastic and viscoelastic properties of the surrounding tissue, these forces are:

- dispersed into the surrounding area,
- redirected at different angles,
- and partially reflected.

This process operates analogously to the behavior of solid bodies in a fluid in hydrodynamics and serves to maintain the integrity of topological structures.

In this context, the skin is not merely a passive covering layer of the body. It is an active organ that can:

- sense mechanical stresses,
- respond to these stresses,
- redirect forces,

- and develop structural adaptations.

Skin Adaptation Mechanisms:

While topological invariants are preserved, the skin employs several adaptive responses:

- Changes in the angles of hair follicles (vectorial adaptation),
- Formation of new hair shafts during the growth cycle (numerical adaptation),
- Skin folding in regions exposed to repeated stress,
- Strengthening over time through the development of fibrotic tissue (structural adaptation).

These mechanisms show that the skin is not only a protective barrier, but also a dynamic system that actively adapts to environmental conditions. As topological invariants are maintained, the skin tissue continually reorganizes and adapts itself. This topological and logarithmic framework—composed of keratin fibers that are far stronger, thinner, longer, and more acutely tapered than those found in ordinary human skin—can convert surface tensions into an advantage, exhibiting a tendency to reshape the morphology of the skin.

This internally balanced formation causes long hair follicles that have not yet fully entered the cycle to become compacted and stabilized at the root level. This stabilization, together with the structural support provided by the curvature of the lateral surfaces of the skull, enables the form to evolve into a higher level of morphological organization. At the same time, the intrinsic transverse narrowing of the scalp contributes to the visual camouflage of areas with incomplete hair coverage. However, if this region has a high density of actively cycling follicles, it is a rational outcome—consistent with the system's vector equilibrium—for the remaining isolated hair follicles to incline in the direction opposite to the center of traction. The structure will maintain its own equilibrium. Through the organization of logarithmic, minimal, and mutually supportive micro-angular forces, and the boundary-defining effect of primary topological invariants, this dynamic system can morphologically influence weakerconnected areas of the scalp—particularly regions with high follicular sparsity such as the forehead.

Stationary hair vortices reflecting force vectors

These resulting harmonic topological knots are no longer passive, but function as highly active and powerful centers of tension. Due to their intrinsic fibrotic strength and structural integrity, they can exert effective tensile forces over long distances across the epidermis and, potentially, through deeper fascial layers. This situation triggers the formation of two fundamental, mutually transversal, lamination-like systems within the skin surface and its underlying layers:

- **Contraction/Folding-Oriented Structures**: When tension emanating from a primary harmonic knot pulls the epidermis along a line, any hair follicle situated on the opposite side of this force acts as a resistance point or a mechanical lever. It bends almost at its midpoint, actively participating in and localizing the tension process. This bending effect also draws the follicle itself and the surrounding epidermis inward, resulting in a fold, groove, or lateral indentation.
- **Tension-Oriented** Structures: Transversal to this folding system, a separate force system is likely established by continuous tensions generated by oppositely oriented hairs around whorls or by other organized internal tension foci. These forces define tension lines or anisotropic stretch pathways in the skin, indicating the principal axes along which the tissue is subjected to, or is more susceptible to, stretching.

The complex and dynamic interaction between these two transversal force systems—especially in regions where centers of force intersect and these forces compete or achieve balance—will result in visible phenomena on the skin surface, such as depressions, elevations, retractions, and even areas of apparent translucency. These effects are observable yet remain unaddressed in the current dermatological literature.

A Biological-Scale Analogue of the Burgers Vortex

The classical model of the Burgers vortex is characterized by the balance of radial inflow, axial stretching, and azimuthal swirl components, and is frequently used in fluid mechanics to describe spiral structures (Burgers, 1948; Moffatt, 2011; Vassilicos & Brasseur, 1996).

The multi-layered spiral flow observed in hair whorl regions can be considered a biological analog of Burgers vortex; here, radial inward flow, axial strain, and viscous diffusion simultaneously reach equilibrium in living tissue. The regular arrangement of hair follicles and the high strength of hair fibers are fundamental factors ensuring the stability and regional durability of this spiral flow. Thus, whorl areas offer not only morphological diversity but also superior mechanical stability against continuous flow and load, providing advantages typical of advanced engineering materials in biological systems.

Burgers Vortex and Navier–Stokes Dynamics in the Context of Hair Whorls

The multilayered spiral flow observed in hair whorl regions can be considered a biological-scale analogue of the Burgers vortex, in which radial inflow, axial stretching, and viscous diffusion simultaneously reach equilibrium within living tissue. The orderly arrangement of hair follicles and the high tensile strength of hair fibers are fundamental factors that ensure the stability and regional resilience of this spiral flow. As a result, whorl areas provide not only morphological diversity but also exceptional mechanical stability against continuous flow and loading, offering advantages characteristic of advanced engineering materials within biological systems.

This analytical framework can serve as the mathematical basis for the multilayered and organized flows observed in biological tissues, particularly in structures such as spiral vessels and hair whorls. Therefore, the topological organization of whorl areas in the scalp and the mechanical strength of hair fibers can be regarded as the dynamic and structural counterparts of the Burgers vortex at the biological scale.

The Burgers vortex approaches potential flow asymptotically in its outer region (Kilty, 2005). In potential flows, the velocity potential satisfies the Laplace equation (harmonic function) (Colding & Minicozzi, 1997). In cylindrical and two-dimensional geometries, the solutions to the Laplace equation include logarithmic spiral forms (Batchelor, 1967; Saffman, 1992). The streamlines in the outer region of the Burgers vortex exhibit a spiral structure and are contained within the solution space of potential flow (Kilty, 2005). This approach is based on classical potential flow theory and the properties of harmonic functions on manifolds (Colding & Minicozzi, 1997).

It is clearly observed that, in the outer region of the Burgers vortex, the flow approaches the regime of potential flow. As the system approaches its inviscid and irrotational boundary, the streamlines exhibit a spiral structure. Specifically, by definition, potential flow is characterized by a velocity potential that satisfies the Laplace equation and thus belongs to the class of harmonic functions; this implies that the velocity field in the outer region of the Burgers vortex can also be represented by a harmonic potential. The presence of logarithmic spiral streamlines among the solutions to the Laplace equation in two-dimensional polar coordinates, as documented in the literature, supports the idea that the spiral structures in this region may mathematically manifest as potential flows. Although the spiral streamlines in the outer region of the Burgers vortex do not necessarily conform precisely to the classical logarithmic spiral form, they can still be regarded as part of the potential flow solution space, as they are derived from a harmonic potential. In conclusion, the relationship between the spiral flow patterns in the outer region of the Burgers vortex and harmonic functions represents an important intersection between classical potential flow theory and modern results in geometric analysis.

The relationship between the spiral flow patterns in the outer region of the Burgers vortex and harmonic functions is fully consistent with classical potential flow theory. This analysis highlights the mathematical foundations of the transition from viscous to potential flow and underscores the significance of harmonic functions in physical systems.

One important detail to keep in mind is that, although the skin is capable of stretching and recoiling, there is a maximum level to which it can be compressed. Under sustained pressure, the skin forms fibrotic tissue, and beyond a certain point, this structure can be considered incompressible.

The mathematical formulation of fluid dynamics on curved or topologically complex surfaces often relies on the fundamental theorems of vector calculus—most notably Stokes' theorem, which relates the circulation of a vector field around a boundary to the integral of its curl over a surface (Batchelor, 1967). The Navier–Stokes equations, which form the cornerstone of fluid dynamics, explicitly incorporate the curl operator and enable the description of vorticity and circulation in both classical and biological systems (Panton, 2013).

In biological contexts such as the organization of hair follicles on the scalp, the Hairy Ball Theorem mathematically predicts that singular points (vortices or whorls) are inevitable in any continuous vector field defined on a spherical surface. Direct applications of this theorem in biology are rare in the literature; however, for a comprehensive reference on the general mathematical foundation of vector fields on manifolds, see Frankel (2011). Such singularities are mathematically represented by the vorticity terms in the Navier–Stokes equations, while Stokes' theorem provides a critical bridge between local and global vector field behavior (Moffatt, 2014).

According to Our Topological Hypothesis Model: The spiral patterns and whorl structures observed in the scalp are the combined result of both topological necessities and the principles of fluid dynamics unique to tissue mechanics. In other words, these mathematically derived singularities are manifested as morphological patterns in biological tissue and can be explained in an integrated manner with the physical properties of the tissue. Thus, it is demonstrated that classical mathematical and physical theorems play a fundamental role in shaping biological organization.

Indeed, it has been extensively described in the literature on fluid mechanics and dynamical systems that multifractal spiral structures in Burgers vortex and similar flows generate topological invariance and chaotic behaviors through continuous stretching and rotation (Burgers, 1948; Birman & Williams, 1983; Thurston, 1988; Migdal, 2023).

The multifractal spiral flow observed in the hair whorl region forms a pseudo-Anosov type monodromy on the surface by continuous stretching, twisting and folding (stretch–twist–fold) cycle. Thus, the whorl acts as a dissipative–chaotic attractor that produces complex morphologies at the microscale by chaotic advection while maintaining its topologically invariant (-constant) structure.

Reflections of Chaos Theory in Scalp Organization

Chaos theory's three fundamental mathematical conditions—sensitive dependence on initial conditions, topological mixing, and density of periodic orbits—are defining principles of chaotic behavior in mathematical systems (Alligood et al., 1997).

Hair follicles behave as a temporally and spatially intricate network, which can be represented by these diagrams.

- *Sensitive Dependence on Initial Conditions:* As observed in the morphological balances around the vortex, small initial differences in the system can lead to exponentially growing outcomes over time. This behavior is mathematically expressed as:

$$|\delta z(t)| \approx e^{\lambda t}|\delta z(0)|$$

Here, represents a positive Lyapunov exponent. This suggests that a small perturbation in an existing trajectory can create significant differences in future behavior (Mandelbrot, 1982) and may trigger morphological transitions in the delicate balances around the vortex.

- *Topological Mixing:* This principle can be reflected in the scalp structure as the spiral structures radiating from the vortex center spread to the lower layers of the skin in an irregular but structure-preserving manner, and through complex interlayer interactions.
- *Density of Periodic Orbits*: The cyclical growth patterns of hair follicles and micro-tension changes can create repetitive but hard-to-predict local patterns in the system, reflecting this property.

Therefore, chaos theory provides a framework for understanding why the scalp exhibits both seemingly regular structures like logarithmic spirals and complex micro-level variations and dynamic changes. This can explain the system's capacity to flexibly adapt to environmental influences while maintaining structural integrity.

The Dynamic Role of Hair Whorls in Light of Pseudo-Anosov Flows

Pseudo-Anosov flows, which can model both regular (structure-preserving) and chaotic (complex) behaviors in dynamical systems (Katok & Hasselblatt, 1995; Fathi, Laudenbach, & Poénaru, 2012), offer a new perspective for understanding the function of hair whorls.

- Interpreting Hair Whorls as Active Centers: Within this model, structurally stable hair whorls can be considered not as passive points, but as active reference centers that reflect, distribute, and balance forces to surrounding tissues. This interpretation can be supported by the properties of Pseudo-Anosov trajectories defined by Thurston (1988) and the complex attractors studied by Smale (1967).
- Dynamic Consequences and the Possibility of a "Strange Attractor": The elastic properties of the skin and the assumed active role of the whorls can create a dynamic field that continuously changes but preserves itself around a fixed topological knot (center). This allows the system to produce complex and fractal patterns similar to a "strange attractor" within analytical continuity. In this approach, the vortex is conceptualized not merely as a geometric point, but as an attractor that determines the rhythm of the complex dynamics around it and transforms tension.

Multidimensional Behavior of the Scalp: A Perspective Through Manifold Transformations of Pseudo-Anosov Flows

The mathematical properties of Pseudo-Anosov flows can be associated with various manifold theories to further model the complex topology and dynamics of the scalp:

- Seifert Fibered Structures and Geodesic Flows: Fenley's (2002) studies have shown that under certain conditions, Pseudo-Anosov flows can be equivalent to geodesic flows on Seifert fibered manifolds. This indicates a structure where regular tension orientations in the dermal layers and micro-instabilities around the vortex can coexist, and the system can exhibit both regular and variable behaviors.
- Suspension Conditions and Time-Evolving Structures: The suspension Anosov flows described by Fried (1982) may provide a model for the dynamic organization created by whorl-centered, time-varying follicular orientations in the scalp.
- Mapping Torus Structures and Morphological Transitions: Mosher's (1991) work on 3-manifolds supports the idea that whorl-centered patterns can be considered as systems that are not only geometric but can also evolve temporally and be restructured through interlayer transitions. From this perspective, "The whorl acts as the fixed point of the system; its surroundings host a flow topology that can extend from Seifert fibers to Anosov transitions."

Projections of Pseudo-Anosov Structures, Braid Diagrams, and Scalp Dynamics

As Zhirov (1995) stated, the analytical projections of Pseudo-Anosov systems can form "strange attractors." These are not classical strange attractors, but traces of strange attractors. This parallels the spiral exit patterns and micro-level variability observed in the scalp.

- Applicability of Braid Diagrams: As emphasized by Birman & Brendle (2005), these complex dynamics can be modeled with braid diagrams. The temporally and spatially intricate braid-like behavior of hair follicles can be represented with these diagrams.

- Topological Entropy: The complexity degree of Pseudo-Anosov homeomorphisms and associated braids is often measured by the topological entropy, expressed as the logarithm of the dilation factor:

$$h(f) = \log(\lambda(f))$$

Similarly, for a braid b, the topological entropy is defined as $\mathrm{Ent}(b) = \log(\lambda(b))$ (Birman & Williams, 1983).

Pseudo-Anosov Braids and Hodge Theory: The Deep Mathematical Foundations of Scalp Structure

- Importance of Pseudo-Anosov Braids: Pseudo-Anosov braids, classified by Thurston (1988) and studied by researchers such as Fried (1982) and Verberne (2023), offer a sophisticated modeling tool for the complex three-dimensional organization and force interactions in the scalp and their projections in other areas of the body.

Contribution of Hodge Theory

- Hodge theory provides a language to understand the deep mathematical order and symmetries underlying these complex biological structures. One of its fundamental principles is that every de Rham cohomology class has a unique harmonic representative (α), i.e. (Griffiths & Harris, 1978):

$$\Delta\alpha = 0$$

The Hodge decomposition of the complex vector space of k-forms on a Kähler manifold X is expressed as (Voisin, 2002):

$$H^k(X,\mathbb{C}) = \bigoplus_{p+q=k} H^{p,q}(X)$$

This decomposition is critical in the mathematical expression of braid diagrams. The Hodge conjecture (Deligne, 1974; Peters & Steenbrink, 2008) links the topology of algebraic varieties to their subvarieties and suggests that the cohomology classes of Pseudo-Anosov manifolds (such as $H^{p,p}(X) \cap H^{2p}(X, \mathbb{Q})$) can be matched with certain structures in braid diagrams (Carlson et al., 2003). The natural monodromic representation of the braid group (B_n) on the first cohomology group of the surface ($H_1(X)$) (McMullen, 2000):

$$\rho: B_n \to \mathrm{Aut}(H_1(X))$$

connects this cohomological structure to braid diagrams. It has also been shown that the braid group action ($\rho_q : B_n \to U(r, s)$) preserves the decomposition of eigenvalue spaces (Movasati, 2012):

$$H_1(X) = \bigoplus_{q=1}^{a} H_1(X)_q$$

This theoretical infrastructure has been further enriched by the studies of researchers such as Leininger (2004) and Agol (2011).

Conclusion: Synthesis of Topological Necessities, Biological Functions, and Mathematical Modeling

The mathematical modeling of hair whorls, through the combination of fundamental concepts such as logarithmic spirals, the Poincaré-Hopf theorem, Laplace equations, as well as advanced tools like Chaos Theory and Pseudo-Anosov flows, allows us to understand both the static (balanced) and dynamic (variable, evolving) properties of these structures. These modeling efforts reveal that the complex organization of the scalp is based on a delicate balance between topological requirements and biological functions. To avoid creating more complexity, formulas will be provided separately.

addle points. Cross over zones, where two hair streams intersect, behave like hyperbolic fixed points saddles in a pseudo Anosov flow.
tretch and fold kinematics. Individual streamlines elongate along one axis and fold back along another, reproducing the defining stretch fold engine of pseudo Anosov maps.
eparatrix boundaries. The visible parting lines that delineate neighbouring hair flows act as separatrices, marking sharp transitions between distinct dynamical regions.
Topological singularities. horls and cross shaped intersections serve as singular points in the scalp s vector field, mirroring the singular set that anchors pseudo Anosov foliations.
Index sum constraint. The combined index of all singularities on the (topologically spherical) scalp remains fixed at 2, consistent with the uler characteristic requirement for pseudo Anosov surfaces.
oliation architecture. Hair streams organise into coherent, leaf like ribbons analogous to the stable and unstable foliations intrinsic to pseudo Anosov manifolds.
Curved substrate. The scalp s curved, compact geometry supplies the negatively curved stage onwhich pseudo Anosov behaviour naturally unfolds.
Deterministic chaos. Although the global pattern remains intact, local variations persist over time an empirical echo of the high entropy yet structurally stable chaos characteristic of pseudo Anosov systems. (rom old version. ew mathematical model will be added.)

Counter-rotating vortices have been shown to cause upward shear on an elastic surface (noei er and van i ngaarden, 2015). imilarly, elastic instabilities have been shown in many experimental studies to cause Taylor-like eddy currents in high shear bands, leading to visible morphological changes (ardin et al., 2012). According to noei er and van i ngaarden s findings: The scalp vortex works logically a little differently.

Intuitively, it is the same as the torque mechanism. In the outer layer of the hair vortex, under the bald area, there are hair strands folded in opposite directions, converging and diverging. As a person grows, the skull also grows, but there are always areas of tension. At the same time, the hair continues to grow. If we consider that the field is acting with the same force, it is intuitively equivalent that this field is fixed but the environment is moving. In a layered, limited elastic tissue with depth, such as the scalp, the vortex normally slides upwards and the forces directed to the surrounding tissues are such that the fine-tipped structure of the hair shaft and the force it directs can easily manipulate the tissue to which it is directed. hen this topological node is combined with growth-induced or structural push , if this upward movement is restricted (e.g. by the general shape of the skull, resistance or other dense tissue layers), these forces are not eliminated but redistributed to the surrounding tissues.

Alopecia Comorbidity Research by Google Gemini DeepReseach

Table 1: Overview of Common Worldwide Lymphomas and Estimated Global Prevalence/Incidence

Lymphoma Type	Brief Description	Estimated Global Incidence/Prevalence (Selected Data)
Hodgkin Lymphoma (HL)	Malignancy characterized by Reed-Sternberg cells.	2020: ~83,000 new cases, ~23,000 deaths globally. ASR (World) Incidence: 0.95 (2022 data). Higher in males. Highest incidence in Southern Europe.
Non-Hodgkin Lymphoma (NHL) (Overall)	Diverse group of malignancies of B-lymphocytes, T-lymphocytes, or NK cells; accounts for ~90% of lymphomas.	2018: ~510,000 new cases. 2020 ASR Incidence: 5.8/100,000; Mortality: 2.6/100,000. Rising incidence trends.
Diffuse Large B-Cell Lymphoma (DLBCL)	Most common aggressive NHL subtype in Western countries.	~31% of adult NHL in West. ~170,000 new cases/year worldwide.
Follicular Lymphoma (FL)	Most common indolent NHL subtype.	~22% of adult NHL in West. ~100,000 new cases/year worldwide.
Cutaneous T-Cell Lymphomas (CTCLs) (Overall)	NHLs primarily manifesting in the skin (e.g., Mycosis Fungoides, Sézary Syndrome).	~4% of NHL cases; 10-15% of NHL diagnoses. MF is most common CTCL.
Adult T-cell Leukemia-Lymphoma (ATLL)	Aggressive T-cell neoplasm linked to HTLV-1.	Prevalence high in HTLV-1 endemic areas (Japan, Caribbean, W. Africa). ~1-5% of HTLV-1 carriers develop ATLL. Incidence in N. America 0.06/100,000.
Marginal Zone Lymphoma (MZL)	Generally indolent B-cell NHLs.	~8% of NHL cases in West.
Chronic Lymphocytic Leukemia/SLL (CLL/SLL)	Common leukemia/lymphoma in older adults.	~6% of NHL cases in West.
Plasmacytoma/Multiple Myeloma	Neoplasms of plasma cells.	Incidence of EMPs in MM is 7-18% at diagnosis. POEMS syndrome associated with plasmacytoma is rare.

Table 1: Overview of Common Worldwide Lymphomas and Estimated Global Prevalence/Incidence by Gemini Research

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Table 2: Prevalence and Odds Ratios (OR) of Thyroid Diseases in Major Alopecia Types Worldwide

Alopecia Type	Thyroid Condition	Reported Prevalence in Alopecia Patients (Range %)	Odds Ratio (OR) / Adjusted Hazard Ratio (aHR) (Value, 95% CI)	Key Studies/Regions (Source Snippets)
Alopecia Areata (AA)	Overall Thyroid Disease	8% - 28% (general alopecia) 12.5% (AA) 13.3% (AA) 13.92% (AA, China) 17.3% (AA, Nepal)	OR: 3.66 (2.90-4.61) OR: 4.36 (1.19–15.99)	
	Hypothyroidism	2.3% - 17.3% Subclinical: 5% (HT-related), 10.4%	OR: 1.431 (1.138-1.799) (Causal, European) OR: 1.34 (1.16-1.56) (Causal) OR: 19.61 (4.07–94.41) (Subclinical)	
	Hashimoto's Thyroiditis (HT)	2.9% - 6.1%	OR: 1.396 (1.030-1.892) (Causal, European) aHR: 4.35 (1.88-10.04)	
	Hyperthyroidism	Subclinical: 5.7%	OR: 5.55 (1.73–17.85) (Subclinical)	
	Graves' Disease (GD)	1.4%	aHR: 8.36 (5.66-12.35)	
	Thyroid Autoantibodies (TPO-Ab)	17.7% - 25.7%	OR: 3.58 (1.96-6.53)	
	Thyroid Autoantibodies (Tg-Ab)	-	OR: 4.44 (1.54-12.75)	
	Thyroid Autoantibodies (TR-Ab)	42.7%	OR: 60.90 (34.61-107.18)	
	Toxic Nodular Goiter	-	aHR: 10.17 (5.32–19.44)	
	Nontoxic Nodular Goiter	-	aHR: 5.23 (3.76–7.28)	
Telogen Effluvium (TE)	Any Thyroid Dysfunction	5.7% - 17%	-	
	Hypothyroidism	9.63% (India) 30% (Female study)	Higher severity of hair loss noted	
	Hyperthyroidism	7.4% (India) 20.4% (Female study)	-	
Androgenetic Alopecia (AGA)	Hypothyroidism	Mentioned, but causal link not supported by MR studies	No significant causal OR from MR studies	
	Thyroid Cancer	Mentioned	-	
Frontal Fibrosing Alopecia (FFA)	Any Thyroid Dysfunction	15.7% - 50% Hypothyroidism: 14.7% (Spain), 58% (small cohort)	-	
Lichen Planopilaris (LPP)	Any Thyroid Dysfunction	34% (vs 11% controls)	-	
	Hypothyroidism	29% (vs 9% controls) Prevalence of Hashimoto's: 6.3% (vs 0%)	OR: 1.75 (1.46-2.21) (Meta-analysis)	

Table 2 Comorbidity of Alopecia Types with Thyroid Diseases: A Global Epidemiological and Pathophysiological Review by Google Gemini

This link is the gemini research document. Comorbidity of Alopecia Types with Thyroid Diseases: **A Global Epidemiological and Pathophysiological Review by Google Gemini**

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Comorbidity Category	Specific Comorbidity / Factor	Associated Alopecia Type(s)	Note on Association
Autoimmune	Thyroid Disease (Hypo-/Hyper-)	AA, LPP/FFA, DLE (as part of SLE)	Strong association, particularly hypothyroidism with FFA. LPP association debated/conflicting.
	Vitiligo	AA, LPP/FFA, DLE	Recognized association.
	Systemic Lupus Erythematosus (SLE)	AA, DLE (defining), LPP/FFA, CCCA	DLE is a feature of SLE; others show increased association/risk.
	Rheumatoid Arthritis	AA, LPP/FFA	Associated.
	Psoriasis	AA, LPP/FFA	Associated.
	Inflammatory Bowel Disease	AA	Associated.
	Sjögren's Syndrome	LPP/FFA	Associated.
	ANA Positivity	CCCA, DLE (as part of SLE)	Increased prevalence found in CCCA. Defining feature in SLE/DLE.
Psychiatric/Psychosocial	Depression, Anxiety, Low Self-Esteem	AA, AGA, TE, FD, CCCA, LPP/FFA, DLE	Common across nearly all alopecia types due to visible nature of hair loss.
Metabolic/Cardiovascular	Metabolic Syndrome (MetS)	AGA	Strong association, AGA considered a potential marker.
	Cardiovascular Risk Factors (HTN, Dyslipidemia, IR)	AGA	Strong association linked with MetS.
	Hypertension, Diabetes, Hyperlipidemia	LPP	Association is conflicting; recent large meta-analyses suggest **no** significant link.
	Obesity, Heart Failure	LPP	Recent large meta-analyses suggest **no** significant link.
Nutritional	Iron Deficiency	TE, AA	Common trigger/exacerbating factor, especially for chronic TE.
	Vitamin D Deficiency	AA	Potential link suggested.
	Protein Deficiency / Crash Diets	TE	Recognized triggers.
Atopic	Atopic Dermatitis, Asthma, Allergic Rhinitis	AA	Strong association, linked to earlier onset/severity.
Other Systemic/Related	Benign Prostatic Hypertrophy (BPH)	AGA	Associated, shared androgen pathways.
	PCOS-like phenotype (males)	AGA (early onset)	Suggested association.
	Urolithiasis	AGA	Potential association in men.
	Severe COVID-19	AGA (males), TE (post-infection)	AGA suggested as risk factor (debated). TE is a common sequela.
	Rosacea	FFA	Frequently associated cutaneous condition.
	Staphylococcus aureus Colonization	FD	Frequent finding, potential trigger/perpetuator.
	Androgenetic Alopecia	FDLPPPS	Common comorbidity in the overlap syndrome.
	Seborrheic Dermatitis	FDLPPPS	Common comorbidity in the overlap syndrome.

Table 3 :Alopecia: Classification, Global Burden, and Associated Comorbidities By Google Gemini

https://docs.google.com/document/d/19Bb8d1MZGzHyn0DDBLccfHd-5n4KD5zrfesL4feV6rE/edit?usp=sharing

This link is the gemini research document. **Alopecia: Classification, Global Burden, and Associated Comorbidities by Google Gemini.**

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Conclusion and Discussion

This article presents an original and innovative hypothesis that transcends classical medical paradigms by focusing on the topological and mechanical properties of human skin and scalp. The HTH proposes that undetectable mechanical stress transmitted through topological knots may lead to various diseases, a concept directly supported by advanced mathematical and physical principles including the Hairy Ball Theorem, Poincaré-Hopf theory, Hodge theory, and Navier-Stokes dynamics.

The model proposed here emphasizes that diseases represent far more than merely "genetic" or "random" phenomena and are shaped by physical and topological constraints. This approach does not contradict existing biochemical mechanisms; rather, it provides an overarching framework that encompasses them. Particularly in conditions such as alopecia, all biochemical processes appear to be compatible with mechanical stress.

The simple imaging techniques employed (including negative inversion and contrast enhancement) can be practically tested without additional equipment or high costs. Notably, HTH appears to unify numerous autoimmune or "idiopathic" diseases within a mechanical-topological framework, extending beyond the fragmented and speculative explanations currently prevalent in the field.

Practical Testability and Application

- The hypothesis can be tested through clinical observations, biomechanical simulations, and controlled procedures such as chemical peeling.
- Specifically, computer-assisted imaging and visual analysis of hair whorls and tension focal points on the skin may verify the predicted mechanical stress distribution.
- In clinical practice, areas suspected to be under the influence of a "topological knot" can be subjected to minimal, reversible, and ethically approved interventions by qualified professionals.

- Limitations and Biases

- The current findings are based on a single human case and self-observation. While experiments conducted on mice are valued in science, this unique human case should not be overlooked; however, it is not generalizable, and scientific reliability will require independent, blinded, and large-scale studies.
- All hypotheses should be repeatedly tested by multidisciplinary teams and remain open to criticism from various fields of expertise.
- The requirements for technological infrastructure, imaging quality, and clinical experience should not be overlooked.
- Observational bias, limited sample diversity, and the restricted adoption of the method represent the primary constraints.

Future Perspective

- Should this hypothesis be validated, the etiology of numerous "unexplained" dermatological and systemic diseases—particularly autoimmune conditions—may shift to a fundamentally different paradigm.
- This carries the potential for a genuine paradigm shift in the efficient utilization of limited healthcare resources and disease prevention.
- Particularly in cases that are difficult to diagnose or progress chronically, this model could be integrated into next-generation diagnostic and treatment algorithms.

If I were not so confident in these results, I would not have invested this much effort. But in science, verifiability cannot be achieved through individual experience alone. So—don't just take my word for it, and don't try this on your own; seek proper ethical approval first. After all, even "being sure" comes with its own set of rules.

Last Note

This article could serve as an example of answering the question, How not to write an academic paper It may not adhere to formal standards. The purpose here is not academic concern. onetheless, updates and revisions will be made as needed. The goal is to present the compilation of an overlooked phenomenon through visual materials and offer a new perspective on diseases.

The unusual nature of the methodology either demonstrates that this approach is nonsense or may lead to a paradigm shift. rom a dogmatic perspective, it might seem nonsensical.

My field is actually physics, but due to ADHD, I wasn t able to organize myself and be sufficiently meticulous to achieve academic success, so I didn t continue. However, this didn t stop me from staying curious.

ut to me, being a scientist and achieving academic success might not always be the same thing. The dogmas in science and some procedures I consider unnecessary are what I believe keep science from seeing things from different perspectives.

I appreciate your interest and critical feedback

I hope this work will serve as a small light for the future, and as a resource for those seeking new answers

Although I am very careful, I know myself and I definitely made many mistakes. lease let me know and I will revise. nderstanding this topological structure and its relationship with diseases was about 4.5 times easier than explaining it. I wish patience and success to everyone who has an academic life. :)

If I am wrong, at worst I will be remembered as an independent researcher who challenged convention, and we will have simply eliminated one more possibility from the scientific record.

ut if I am right

Actually, nothing will change. The direction we look at, our perspective will change.

This article is not yet fully completed. It will be completed.

Approximately 1000 visual data and 300 video dermoscope data will be donated to research institutions. Communication has started.

I may have shortcomings and mistakes. I have no concerns about my academic career, I would never knowingly commit something like plagiarism, but I do not have sufficient access to academic resources. Necessary corrections will definitely be made.

I am completely against the sale of scientific articles for money. This is an obstacle for our own species.

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