

A Literary Review of ‘*Twak Sharir*’ with special reference to Contemporary Science

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ABSTRACT

Twak (Skin), the largest organ, also known as *Sparshnendriya* out of five *Gyanendriya* (Sense organs) described in Ayurveda. *Twacha* is given as *Upadhatu* of *Mamsa Dhatu* i.e. by-product during the transformation of *Mamsa dhatu*. Skin is a self-repairing layer that protects bodily structures from the external environment. In Ayurveda different layers of the skin are described at the microscopic level depending upon the site of different diseases of the skin. In modern science layers of the skin are described in detail according to structure. Skin is capable of reflecting outwardly the inner health of the body. In Ayurveda also *Acharya Charak & Sushrut* has dedicated chapters explaining *Arishtha Lakshana* (Ominous signs) of *Varn/Twak* suggestive of prognosis of the disease. Contemporary science has tools and instruments that Ancient Acharya lack and yet the literally research of comparative study can give us glimpse of keen and unique observations of Ancient Scholars of Ayurveda.

Key Words *Twak / Twacha*, Skin, Layers of Skin

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INTRODUCTION

Ayurveda is an ancient & holistic system of medicine. Skin is the largest organ constituting 15 -20% of total body mass¹. Ayurveda describes seven distinct layers of the skin, each with its own structure and function. The layers are designed so that each layer provides support to the layers above it. The skin need to be healthy and balanced through all its layers to perform all its functions effectively. Ayurveda describe the

organization of the body in term of *Doshas*, *Dhatus* and *Malas*. *Twak/Twacha* (Skin) is one among the *updhatus* of *mamsa dhatu* which provide protective layer over the body that protect from the heat, cold & external infection². Skin is the largest of all sense organs which sense touch, pain, pressure, temperature etc. It is also known as “The First Line of Defence”³. The fusion of *shukra* (spermatozoa) & *shonit* (ovum) while being cooked (processed by heat) give rise

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to the formation of seven *Twak* just like formation of cream when milk is boiled⁴. Acharya *Sushrut* has described *Twaka Shareeram* in detail. It is anatomical structure of skin by *Sushrut* thousands of years ago when modern sophisticated instruments & equipment's were not available.

Since antiquity human being often suffered from many type of diseases, out of them skin disease is one of the major problem for the community, as there is a change in the structural appearance of the skin & it make entire body look ugly. There are different theories among the Acharya regarding the number of layers. Acharya *Charak* stated that *Twak* is made of six layers where other Acharya states seven layers. Specific details are also given such as the thickness of each skin layer, its function and possible vulnerability of diseases at that layer. The embryogenesis, anatomy and physiology, as well as the cause of various skin diseases, are described in our classical text with great precision. Skin is said to be a mirror of one's physiology, hence reflecting the inner health or disorder.

This article lays emphasis on the known and the lesser known literally review of *Twak Sharir*, its correlation with contemporary science especially in Anatomical (Structural) and Physiological (Functional) aspect.

Etymology (*Nirukti*) of *Twak*

In Ayurveda, skin is called as *Twak* or *Twacha*. It is included under “*Panch Gyanendriya Adhithana*.” It has a great capacity of expansion and stretching. *Twacha* is the *adhithana* of

“*Vata dosha*”. *Vata* resides here and bring out its functions. *Twacha* is specialized sense organ which acquires special sensory perception of pain, touch, pressure, heat and cold.^{5,6}

Synonyms for *Twak*

Twacha, *Charma*, *Sparshan*, *Chavi*, *Chadani*, *Asrugdhara*, *Romabhumi*, *Ajin*, *Kruti*, *Dehacharma*, *Shariravaranam*, *Asrugvara*, *Shariravarakam Shastram* *Derma*, *Dermis*.⁷ are some synonyms used for skin.

Twak Utpatti: Embryology

According to Ayurveda, the development of *Twacha* (skin) occurs in *Tritiya masa* (third month) of intrauterine life.⁸ Although different Acharyas have stated different opinions regarding the development of *Twacha*.

Acharya *Sushrut*, in *Shareersthana* explained that *Twacha* develops like *Santanika* (cream) developing on *Ksheer* (milk) while heating milk.⁹⁻¹⁰ Acharya *Charak* states that during the process of *shukra shonit sanyoga* and the formation of all *sapta dhatu twacha* is formed.¹¹

Acharya *Vagbhat* explained the development of *Twacha* by *dhatvagni*. due to *paka* of *Rakta dhatu*¹²

Indu in his commentary “*Shashilekha*” explains the skin layers by giving an example of *Kadalidal* i.e. Stem of Banana. Similar to several layers of stem of banana skin has its layers arranged in systematic concentric pattern. According to *Indu*, *Twacha* results from *Sara (Prasad) bhaga* of *Rakta dhatu* hence shiny – lustrous appearance.¹²

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Hemadri's commentary "Ayurved Rasayan" depicts the similar explanation as the most of others. In "Panchmahabhautik sharir", *Twacha* is formed by metabolism of *Rakta dhatu* by *Raktagni* over outer surface of embryo.¹³

Bhavaprakash gave very different theory about formation of *Twacha* that it is formed by *Pachan* that is metabolism of *Shukra* and *Rasa Dhatu*.¹⁴

Twak Uttapati Kala

According to Charak *Bala-Varna-Upachaya* are observed in sixth month of intrauterine life. *Varna* (complexion) being the attribute of skin we can depict that *Twacha* is formed in sixth month of intrauterine life. According to *Astang Sangraha & Hridaya Kasha, Roma, Nakha, Asthi, Snayu, Bala, Varna, Sira* and *Twacha* develops in sixth month of intrauterine of life. As per modern sciences all layers of skin develops in fourth month of intrauterine life.^{11, 12, 13}

Rachanatmak Twak

In Ayurveda Samhita several layers of *Twacha* has been described and named according to different skin disorders observed in different layers of skin (*Twacha Stara*) Thicknesses and functions performed by these layers are also described. Description of these skin layers is given from superficial to deep. Its thickness is measured in "Vrihi" i.e. thickness of paddy or barley. There are controversial opinion about number of skin layers according to prospective vision of surgeon and physician.

Table No.1- Different opinions of Acharya according to layers of *Twacha*¹⁵.

Table No.2- Descriptions of skin layers according to Sushrut, Charak and Modern Science as follows^(11, 12, 24, 25, 26)

Kriyatamaka aspect of Twack –

Kriyatamaka (Physiological) aspect of *Twacha* is described in Ayurvedic text as *Dosha, Dhatu & Mala Sambandha* of *Twacha*.

Panch Bhautiktam – *Twacha* is one of the five sensory organs (*Dnyanendrias*) and has dominance of *Vayu Mahabhut* which is related with touch sensation. *Twacha* is the *Upadhatu* of *Mamsa* which covers whole body and protects inner organs of body. Skin and hairs are mainly *Parthiv* (earthly nature), glow, colour are *Agneya* (nature of fire), hair pits (*Lomkupas*) and opening of sweat glands are *Akashiy* (characteristics of space or ether), *Rasa* and lymph are *Jaliya* (nature of water).¹⁶

Role of Dosha – The site of *Vata, Pitta, & Kapha* are mentioned as per unique function exhibits by them throughout the body.

Vata Dosha- *Vata Dosha Vriddhi* in the body results in *Karshanyam* (hyperpigmentation) of *Twacha*. *Pitta Dosha*- *Bhrajak pitta* present in *twacha* is responsible for lustre. The *pittadosha vriddhi* leads to yellowish discoloration of skin and its *kshaya* causes the loss of lustre. *Kapha Dosha*- *Tarpak Kapha* is related with nourishment of *Twacha*. *Kapha kshaya* results in *rukshata* (dryness) whereas *Shaukalyam* (whitish discoloration) and *shaityam* (coldness of skin are signs of *Kapha vriddh*^{9, 18}

Role of Dhatu – Out of *saptdhatu, Rasa* and *Rakta Dhatus* might be related to physiology of
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Twacha. Acharya Charak while explaining the *Ashtasaar purush*, described *Twaksaarpurush* first whereas other Acharya explains the same as *Rasasaarpurush*.¹⁶

Rakta Dhatu is responsible for skin diseases like *Visapra*, *Kustha*, *Vyanga* etc. and also it's *Kshaya* causes *Twakaparushyam* (rough skin).

Again the luster of the *Twacha* is sign of presence of *Shudh Shukra*.

Role of Mala – *Sharangdhara* describes *Sweda* as salty secretion from *Twacha* which helps to excrete waste products out of the body (*Kleda vahanam*). It maintains moisture content, skin tone elasticity & smoothness of *Twacha* (*Tvak sukaumarya*), and it also performs function of *Romadharan*^{9, 12, 17}. The *Prakrit Karma* is maintaining the moisture content, tonicity and elasticity of skin, in view of *Kashaya* and *Virdhi* shows dryness and cracks, *Pruritus* (severe itching of skin) respectively.^{17, 18}

Role of Twacha in Rogamarga – Acharya Charak describes *Bahya* (*Shakha, Raktaadi Sapta dhatu & Twak*), *Madhya* (*Marma, Basti, Hridya, Murdha, Asthi, Snayu, Kandra*), *Abhyantara* (*Kostha* i.e. *Mahastrotas, Sharir Madhaya & Pakvashaya*) as three *Rogmargas*. *Twacha* is included in *Bahya Rogmarga* because skin being the outermost layer comes first in contact with every element in external environment.¹¹ Hence, *Twacha* is first line of defense.

Role of Twacha in Gyanendriya – Touch sensation is work of *Vayu Mahabhuta*. Sensation of touch is carried out by *Sparshanendriya* and *Twacha* is its *Adhishthana*. *Twacha* covers

external part of the body that includes other sense organs too.¹¹

Chaya & Prabha – *Chaya* (shadow) circumscribes the complexion of the body whereas the *Prabha* (luster) illuminates the complexion. *Charak* describes that shadow can be observed from nearby whereas luster illuminates from distance. The Type of shadow as based on *panchamahabhutas* and its signs and symptoms as indicative of imminent death.¹⁹

Modern science literature

Skin is the largest organ of body. It is uniformly thick at some places; also thick and thin at some place. Average thickness is about 1 to 2 mm. There are two layers of skin. Thin or hairy skin - It is very thin and contains hair and found all over the body except palm and sole. Thick or glabrous skin - Epidermis is very thick with thick layer of stratum Corneum, having no hairs and at palm and sole.

Embryology

According to Modern text development of skin is observed around fourth week after the fertilization starts. Within first eight weeks of gestation, organogenesis takes place. Here establishment of the rudimentary structures of all organs and tissues occurs from the ectoderm, mesoderm and endoderm in the developing embryo. The ectoderm gives rise to epidermis while dermis is derived from mesoderm located deep into the surface ectoderm. The multipotent epithelial cells of ectoderm develop into stratifying epidermis that develops into future epidermis. The epidermal appendages seen

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during development are primitive cells of organ development and ultimately vaginate into dermis to form hair follicles appendages, apocrine, and eccrine glands. Nearly by the eleventh week, dermis and epidermis are developed and hair follicles start to grow. Sebaceous glands develop around 13-14 weeks of gestation³.

Structure - Consists of two layers.

1. Superficial layer is called epidermis, made up of stratified squamous epithelium.
2. Deep layer is called dermis made up of connective tissue.

Epidermis

Layers of Epidermis

1. Stratum Basale - It is deepest or basal layer which is made up of single layer of columnar cells that rest on a basal lamina which contains stem cells and called as germinal layer- stratum germinative as by undergoing mitosis keratinocytes form more superficial layers.
2. Stratum spinosum – It is also germinative zone of epidermis, sometimes by undergoing mitosis form skin layer here.
3. Stratum Granulosum – There are 1 to 5 layers of flattened cells characterizing presence of deeply staining granules in their cytoplasm. Here, Keratin filaments are more numerous and arranged in the form of thick layer.
4. Stratum Lucidum - (lucid-clear) called due to homogeneous appearance.
5. Stratum Corneum – Most superficial layer of epidermis, made up of flattened scale like element (squamous) containing keratin filaments embedded in protein. Glue like material

containing lipids and carbohydrates hold it together.

Epidermis consists of two types of cells - 1.Keratinocytes, 2.Non-keratinocytes - including melanocytes, dendritic cells of legerhance and cells of Merkel.

Keratinocytes - are predominant cells of epidermis, forms from stem cells present in basal layer by further mitosis of intermediate stem cells. Then after there is no further cell division.

Melanocytes – Derived from melenoblast that arises from neural crest and are responsible for melanin synthesis. Color of skin is influenced by melanin presence.

Dendritic cells of Langerhans – Originate in bone marrow and playing important role in protection of skin against viral and other infections and controlling the rate of cell division in epidermis. It increases in chronic skin diseases due to allergy. It is present in oral mucosa, vagina and thymus and belongs to mononuclear phagocyte system.

Cell of Markel – Sensory nerve ending are present in these cells in basal layer of epidermis.

Dermis

Dermis is made up of connective tissue and stout collagen fibers, fibroblasts and histoiocytes and is divided in two layers.

Papillary layer – Forms superficial layer of dermis and includes the dense connective tissue of dermal papillae which are best developed in thick skin of palm and sole. It contains blood vessels lymphatic, nerve fibers and chromate ores (pigments).

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Reticular layer – This layer is made up of reticular and elastic fibers. Fibers are found around the hair bulbs, sweat glands, and sebaceous gland. Immediately below the dermis, sub cutaneous tissue in prunes.

Hypodermis (Subcutis)

It lies below dermis & connects skin to underlying fascia (fibrous tissue) of bone & muscles. It is difficult to distinguish border between hypodermis & dermis which consist of vascularized, loose, areolar connective tissue & adipose tissue which are functioning fat storage and providing cushioning for skin.

Colour of skin

Different factors influence the colour of skin especially melanin, carotene and haemoglobin. Melanin is pigmented polymer produced by melanocytes which are scattered throughout stratum basale of epidermis. Change in colour of skin is often related to either over production or abnormal production of melanin pigment.

Cutaneous vessel blood circulation affects the colour of skin. For example, pale in decreased haemoglobin, pink in haemodialation and bluish in cyanosis.

Blood supply

Blood supply is done by number of arterial plexuses, deepest plexus presents over deep fascia, just below the dermis and just below the level of papillae. Capillary loop arising from this plexus pass into each dermal papilla. Blood vessels do not penetrate into the epidermis, epidermis derives nutrition by diffusion from capillary. Veins from dermal papillae drain into

venous plexus lying on deep fascia. The presence of arterio venous anastomoses, regulates blood flow through the capillary bed and helps to maintain body temperature.

Nerve Supply

Being a largest sense organ, skin has many nerve endings forming specialized cutaneous receptors also known as mechanoreceptors. Sensations of touch, pain, pressure or temperature are conveyed the brain via afferent nerves on stimulation. At the brain level, perception of different sensations occurs. Superficial part of dermis is supplied by sensory nerves, and autonomous nerve supplies to smooth muscles in the wall of blood vessels and sweat glands.

Free nerve endings – These are also known as nociceptors. These are receptors for pain. These are located in the dermis around the base of hair follicle and close to the epidermis where the hair emerges the skin. These are receptors for heat and cold also have high threshold for mechanical, chemical and thermal stimuli.

(Pacini) Pacinian corpuscle – these are large, ovoid structures spread over most organs and tissues including deep dermis and hypodermis. In pacinian corpuscles cell are formed around axon giving typical appearance of onion bulb. Functionally, they respond to pressure and vibration stimuli.

Meissner's Corpuscles – these are especially concentrated in skin areas sensitive to discriminative fine touch such as fingertips, palms and soles, lips, genitalia skin etc. they are

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located just below the epidermis, in dermal papillae.

Ruffini's Corpuscles – These are spread in the dermis, ligaments and joint capsules. These are known to be thermoreceptors and recently observed to be responsive to tactile stimulus.

Muscle

Arrector Pili Muscle – These are smooth muscles attached to hair follicle which on contraction causes hair to stand up on end. When frightened or cold, hair follicles are pulled outward causing formation of Goosebumps or dimpling. These muscles are also responsible for emptying of sebaceous glands by squeezing them.

Physiologic desquamation

Epidermis is continuously renewing layer and give rise to derivative structures such as hair follicles, nails, sweat glands etc.

The basal layer of epidermis provides cells for renewal by proliferation. The basal layer a.k.a. stratum germinativum is primary site for mitotically active cells that give rise to cells of outer epidermis. Clonogenic stem cells in the basal layer produce number of cells through continuous cycling very slowly under normal conditions. These newly form cells migrates from the basal layer to the cornified layer and then transit from cornified layer to the outermost epidermis.

Stratum spinosum is squamous layer of epidermis overlying the basal layer and contains variety of cells. Here precursors for stratum corneum lipids are delivered. Cells are pushed into upper part of stratum spinosum and then into stratum

granulosum. Here cells are flattened containing abundant keratohyaline granules into their cytoplasm.

Stratum granulosum contain high level of lysosomal enzymes as it is keratogenous zone of epidermis. Here dissolution of organelles and nuclei takes place because of process of abrupt terminal differentiation.

In stratum corneum as the horny cells have already loss their nuclei during terminal differentiation, they are consider to be dead cells. Here cells are large and flat with polyhedral shape which is rich in protein and low on lipids.

Throughout the life this continuous process of regeneration of cells takes place maintaining constant epidermal thickness. This is a major homeostatic mechanism in the skin. Here the terminal differentiation is type of apoptosis converts keratinocytes into protective corneocytes.²⁰

Surgical Considerations

Surgical incisions are usually made along the relaxed skin tension lines to improve healing and reduce scarring, especially in cosmetic surgical procedures. Langer's Lines: The collage and elastic fibbers' in the reticular dermis form regular lines of tension in the skin. The skin incisions made along these lines are more accurate as it will cause less scarring.²⁶

Clinical Significance

Skin is divided into multiple areas called dermatomes. There are 30 dermatomes on the body, numbered according to the level of spinal vertebral from which they arise. There are 7

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Cervicals, 12 Thorasics, 5 Lumbar, and 5 Sacral. These dermatomes are helpful in diagnosis of vertebral spine injury. Also, certain diseases like shingles have symptoms that involve a dermatome pattern.

Dermatomes and Referred Pain – Sensory information from particular area of skin travels to the brain via the spinal nerves; here area of the skin is dermatome

The five groups of spinal nerves (cervical; C1–C8, thoracic: T1–T12, lumbar: L1–L5 and sacral: S1–S5), reaching the spinal cord where the signals ultimately ascend to the brain.²⁷

Clinical conditions:

- In Ayurvedic Literature, “*Kustha Roga*” is skin diseases. There are of two types – a) *Maha Kustha* b) *Kshudra Kustha*.
- In Modern Literature, various skin disorders are explained. Commonly skin lesions and eruptions are discussed. Some common skin lesions such as: Vesicles, plaques, scales, nodules, papules and patches are dermatological disorders
- Colour and Pigmentation: Following changes in the skin colour indicates few systematic conditions:
 1. Pallor: Anaemia, Haemorrhage and shock.
 2. Pale: Hypopituitarism, Hypogonadism.
 3. Albinism: Congenital absence of hemosiderin pigment.
 4. Cyanosis: Bluish discoloration of skin appears due to lack of oxygen supply to blood

corpuscles such as in Congestive Cardiac Failure & Valvular Septal Defect.

Jaundice: Yellowish Discoloration of skin, nail, & sclera^{28, 29, 30}

Functions-

Protective function – being protective layer all over body and organs skin protects against, Bacteria and toxic substances, Mechanical blow, and Ultraviolet rays. *Sensory function* – Skin has many nerve endings which are specialized cutaneous receptors. They receive stimuli and carry them to brain for perception, hence, alarming about touch, pain, pressure and temperature. *Storage function* – fat, water, chloride, sugar etc. are stored inn skin. Sometimes dilatation of cutaneous vessels leads to storage of blood. *Synthesis function* – synthesis of vitamin D3 takes place with the help of cholesterol. *Regulation of body temperature* – it is mainly done by sweat glands. Skin also loses heat via radiation, conduction, convection and evaporation. Sebaceous glands prevents loss of heat in cold environment. *Regulation of water and electrolyte balance* – by excretion of water and salt through sweat. *Excretory and absorptive function* – fat soluble substances are absorbed whereas, salt, urea etc. are excreted through skin. *Secretory functions* – sweat glands and sebaceous glands secrete their secretions.³¹

DISCUSSION

The Contemporary science literatures have different opinion about skin. But both classical

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and contemporary literatures discuss the layers, pigments, and thickness of skin. Moreover ancient literature describes the diseases which occurred in particular layer of skin.

We can state that *Twak* is well established tool in clinical examination, diagnostic & prognostic aspect in medical science. This study is an effort to bring autocracy about various doubtful concept of *Twak Stara*, which may be useful for scholars, teachers, physicians & surgeon for the purpose of people's interest.

CONCLUSION

The contemporary science describes *Twak Sharir* (Skin) components in similar way however some minor variations may be observed related to layers of skin. The traditional knowledge of Ayurveda mentioned diseases specific to particular skin layer. Skin not only protects internal organs of body from external stimuli but it's also responsible for colour, complexes and pigmentation of body. Disorder of skin (*Twacha*) concludes on somatic level as well as psychological level. To know abnormalities of skin one must have knowledge about normal state of its structure and function of skin and should to be studied in detail.

This study emphasized that a physician as well as surgeon must be aware about involvement of particular skin layer in specific skin disease so that disease cured selectively. In above literary research *Rachanatamk* & *Kriyatamak* aspects of

Twak according to contemporary medical science were studied.

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