Nail (anatomy)

Human nails

Fingernails

Toenails

A nail is a horn-like envelope covering the dorsal aspect of the terminal phalanges of fingers and toes in humans, most primates, and a few other mammals.

Nails are similar to claws, which are found on numerous other animals. In common usage, the word nail often refers to the nail plate only.

Fingernails and toenails are made of a tough protein called keratin, as are animals’ hooves and horns. Along with hair they are an appendage of the skin.

Human anatomy

The nail consists of the nail plate, the nail matrix and the nail bed below it, and the grooves surrounding it.[1]

Parts of the nail

The matrix (synonyms:[2] matrix unguis, keratogenous membrane, nail matrix, onychostroma) is the tissue (or germinal matrix) upon which the nail rests,[3] the part of the nail bed that extends beneath the nail root and contains nerves, lymph and blood vessels.[4] The matrix is responsible for the production of the cells that become the nail plate. The width and thickness of the nail plate is determined by the size, length, and thickness of the matrix, while the shape of the fingertip itself determines if the nail plate is flat, arched, or hooked.[5] The matrix will continue to grow as long as it receives nutrition and remains in a healthy condition.[4] As new nail plate cells are incubated, they emerge from the matrix round and white to push older nail plate cells forward; and in this way yet older cells become compressed, flat, and translucent, making the pink colour of the capillaries in the nail bed below visible.[6]

The lunula (occasionally called simply "the moon") is the visible part of the matrix, the whitish crescent-shaped base of the visible nail.[7] The lunula is largest in the thumb and often absent in the little finger.

The nail bed is the skin beneath the nail plate.[7] Like all skin, it is composed of two types of tissues: the deeper dermis, the living tissue fixed to the bone which contains capillaries and glands,[8] and the superficial epidermis, the
layer just beneath the nail plate which moves forward with the plate. The epidermis is attached to the dermis by tiny
longitudinal "grooves" known as the matrix crests or crests of nail matrix (cristae matricis unguis). As we
age, the plate grows thinner and these ridges become evident in the plate itself.

The nail sinus (sinus unguis) is the deep furrow into which the nail root is inserted.

The nail root (radix unguis) is the part of nail situated in the nail sinus, i.e. the base of the nail embedded
underneath the skin. It originates from the actively growing tissue below, the matrix.

The nail plate or body of nail (corpus unguis) is the actual nail, and like hair and skin, made of translucent keratin
protein made of amino acids. In the nail it forms a strong flexible material made of several layers of dead, flattened
cells. The plate appears pink because of the underlying capillaries. Its (transversal) shape is determined by the
form of the underlying bone.

The free margin (margo liber) or distal edge is the anterior margin of the nail plate corresponding to the abrasive or
cutting edge of the nail. The hyponychium (informally known as the "quick") is the epithelium located beneath
the nail plate at the junction between the free edge and the skin of the fingertip. It forms a seal that protects the nail
bed. The onychodermal band is the seal between the nail plate and the hyponychium. It is found just under the
free edge, in that portion of the nail where the nail bed ends and can be recognized by its glassy, greyish colour (in
fair-skinned people). It is not perceptible in some individuals while it is highly prominent on others.

The eponychium is the small band of epithelium that extends from the posterior nail wall onto the base of the nail. Often
and erroneously called the "proximal fold" or "cuticle", the eponychium is the end of the proximal fold that
folds back upon itself to shed an epidermal layer of skin onto the newly formed nail plate. This layer of non-living,
almost invisible skin is the cuticle that "rides out" on the surface of the nail plate. Together, the eponychium and the
cuticle form a protective seal. The cuticle on the nail plate is dead cells and is often removed during manicure, but
the eponychium is living cells and should not be touched. The perionyx is the projecting edge of the eponychium
covering the proximal strip of the lunula.

The nail wall (vallum unguis) is the cutaneous fold overlapping the sides and proximal end of the nail. The lateral
margin (margo lateralis) is lying beneath the nail wall on the sides of the nail and the nail groove or fold (sulcus
matricis unguis) are the cutaneous slits into which the lateral margins are embedded.

The paronychium is the border tissue around the nail and paronychia is an infection in this area.

Function

Aesthetics aside, a healthy (finger)nail has the function of protecting the distal phalanx, the fingertip, and the
surrounding soft tissues from injuries. It also serves to enhance precise delicate movements of the distal digits
through counter-pressure exerted on the pulp of the finger. The nail then acts as a counterforce when the end of
the finger touches an object, thereby enhancing the sensitivity of the fingertip, even though there are no nerve
endings in the nail itself. Finally, the nail functions as a tool, enabling for instance a so called "extended precision
grip" (e.g. pulling out a splinter in one's finger).
Growth

The growing part of the nail is the part still under the skin at the nail’s proximal end under the epidermis, which is the only living part of a nail.

In mammals, the length and growth rate of nails is related to the length of the terminal phalanges (outermost finger bones). Thus, in humans, the nail of the index finger grow faster than that of the little finger; and fingernails grow up to four times faster than toenails. [12]

In humans, nails grow at an average rate of 3 mm (0.12 in) a month (as they are a form of hair).[13] Fingernails require 3 to 6 months to regrow completely, and toenails require 12 to 18 months. Actual growth rate is dependent upon age, gender, season, exercise level, diet, and hereditary factors. Nails grow faster in the summer than in any other season.[14] Contrary to popular belief, nails do not continue to grow after death; the skin dehydrates and tightens, making the nails (and hair) appear to grow.[15]

Medical aspects

Healthcare and pre-hospital-care providers (EMTs or paramedics) often use the fingernail beds as a cursory indicator of distal tissue perfusion of individuals that may be dehydrated or in shock.[16] However, this test is not considered reliable in adults.[17] This is known as the CRT or blanch test.

**WEJ Procedure:** briefly depress the fingernail bed gently with a finger. This will briefly turn the nailbed white; the normal pink colour should be restored within a second or two. Delayed return to pink colour can be an indicator of certain shock states such as hypovolemia.[18] [19]

Nail growth record can show the history of recent health and physiological imbalances, and has been used as a diagnostic tool since ancient times.[20] Deep transverse grooves known as Beau’s lines may form across the nails (not along the nail from cuticle to tip) and are usually a natural consequence of aging, though they may result from disease. Discoloration, thinning, thickening, brittleness, splitting, grooves, Mees’ lines, small white spots, receded lunula, clubbing (convex), flatness, spooning (concave) can indicate illness in other areas of the body, nutrient deficiencies, drug reaction or poisoning, or merely local injury. Nails can also become thickened (onychogryphosis), loosened (onycholysis), infected with fungus (onychomycosis) or degenerate (onychodystrophy); for further information see nail diseases.
Health and care
Bluish or purple fingernail beds may be a symptom of peripheral cyanosis, which indicates oxygen deprivation. Nails can dry out, just like skin. They can also peel, break, and be infected. Toe infections, for instance, can be caused or exacerbated by dirty socks, specific types of aggressive exercise, tight footwear, and walking unprotected in an unclean environment.
Nail tools used by different people may transmit infections. Nail files, "if ... used on different people, ... may spread nail fungi, staph bacteria or viruses," warns Ted Dischman, a spokesperson for the California Board of Barbering and Cosmetology. In fact, over 100 bacterial skin infections in 2000 were traced to footbaths in nail salons. To avoid this, new improved contactless tools can be used, for example, gel and cream cuticle removers instead of cuticle scissors.
Nail disease can be very subtle and should be evaluated by a dermatologist with a focus in this particular area of medicine. However, most times it is a nail technician who will note a subtle change in nail disease. Inherited accessory nail of the fifth toe occurs where the toenail of the smallest toe is separated, forming a smaller, "sixth toenail" in the outer corner of the nail. Like any other nail, it can be cut using a nail clipper.

Fashion
Manicures and pedicures are health and cosmetic procedures to groom, trim, and paint the nails and manage calluses. They require various tools such as cuticle scissors, nail scissors, nail clippers, and nail files. Artificial nails can also be appended onto real nails for cosmetic purposes.
A person whose occupation is to cut any type of nail, apply artificial nails, and care for nails is sometimes called a nail technician. The place where a nail technician works may be a nail salon or nail shop (also nailshop).
Painting the nails with nail polish (also called nail lacquer and nail varnish) is a common practice dating back to at least 3000 B.C.

Evolution
The nails of primates and the hooves of running mammals evolved from the claws of reptiles. In contrast to nails, claws are typically curved ventrally (downwards in animals) and compressed sideways. They serve a multitude of functions — including climbing, digging, and fighting — and have undergone numerous adaptive changes in different animal taxa. Claws are pointed at their ends and are composed of two layers: a thick, deep layer and a superficial, hardened layer which serves a protective function. The underlying bone is a virtual mould of the overlying horny structure and therefore has the same shape as the claw or nail. Compared to claws, nails are flat, less curved, and do not extend far beyond the tip of the digits. The ends of the nails usually consist only of the "superficial", hardened layer and are not pointed like claws.
With only a few exceptions, primates retain plesiomorphic (original, "primitive") hands with five digits, each equipped with either a nail or a claw. For example, all prosimians (i.e. "primitive" primates or "proto-primates") have nails on all digits except the second toe which is equipped with a so called toilet-claw (i.e. important for grooming activities). The needle-clawed bushbaby (Euoticus) have keeled nails (the thumb and the first and the second toes have claws) featuring a central ridge that ends in a needle-like tip. In tree shrews (primate-like rodents) all digits have claws and, unlike most primates, the digits of their feet are positioned close together, and therefore the thumb cannot be brought into opposition (another distinguishing feature of primates).
A study of the fingertip morphology of four small-bodied New World monkey species, indicated a correlation between increasing small-branch foraging and
1. expanded apical pads,
2. developed epidermal ridges (fingerprints),
3. broadened distal parts of distal phalanges (fingertip bone), and
4. reduced flexor and extensor tubercles.

This suggests that whereas claws are useful on large-diameter branches, wide fingertips with nails and epidermal ridges were required for habitual locomotion on small-diameter branches. It also indicates keel-shaped nails of Callitrichines (a family of New World monkeys) is a derived postural adaptation rather than retained ancestral condition. [23]

See also

- List of cutaneous conditions
- Nail fetish

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