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A comprehensive review on human nail

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Abstract
A nail is a keratinized structure that protects the fingertip and the adjacent tissues from injuries. The epithelial matrix cells attached to the nail bed gives rise to the formation of nail. A healthy nail gives translucent pinkish hard but flexible smooth and shiny appearance. The growth rate of nail is more in children than adults. Structurally Human nail is composed of many parts which are reviewed in this article and performs many functions. Human nails are good indicator and very helpful in diagnosis of many diseases.

Keywords: nail, keratin, hyponichium, eponichium, lunula

Introduction
A nail is a horny structure formed by the invagination of epidermis into the dermis. The maturation and differentiation of the epithelial nail matrix cells make the nail that is tightly attached to the nail bed, which a little bit contribute to nail formation. It is also known as onyx, composed of Keratin protein that is also found in skin and hair. The protein Keratin in nails is harder than the keratin found in hair and skin. A nail is envelope like covering that covers the dorsal part of the terminal phalanges of fingers and toes in humans, primates and in few other mammals. The nails are similar to claws, hooves and horns, which are also keratinized structures, found on other animals.

A healthy nail is hard but flexible. The surface is whitish, smooth, shiny and unspotted without any ridges, pits or splits. A healthy nail gives translucent appearance with pinkish color of the nail bed showing through it. A healthy nail may look dry and hard but its actual water content is between 15-25 percent. The water content of the nail affects its flexibility. The rigidity of the nail is inversely proportional to its water content i.e. lower the water content more will be the rigidity of the nail. The physicochemical properties of the nail indicate that nail behaves more like a hydrophilic membrane and the stable disulphide bonds, responsible for the hardness of the nail, are seem to restrict drug penetration.

The growing part of the nail lies at the proximal end below the epidermis and is the only living part of the nail. In mammals, the length and growth rate of nails is directly proportional to the length of the terminal phalanges. Hence in human beings, the nail of the index finger increase faster than that of the little finger and the fingernails grow up four times faster than toenails. The average nail growth rate in healthy adult is about 1/10 of an inch (2.5-3 mm) per month. There are many factors that affect the nail growth rate, which are as follows:

- Children's nail growth rate is more as compared with adults; nail growth rate becomes slow in old age
- Nail growth rate is faster in summer than in winter
- Pregnancy also affects the nail growth because of hormonal changes in the body. The growth of nail is faster during the last trimester of pregnancy and becomes normal quickly after delivery as hormone level becomes normal
- Nails grow up at faster rate on middle finger and slowest on thumb and finger nails grows faster than toenails

Actually, the nail growth rate is related to sex, age, nutrition, seasonal weather changes, hereditary factors and level of exercise. It is believed that nails do not grow after death due to dehydration of skin.

Structure and Anatomy of Human nail
Located on the distal part of each digit, Nails (with hair, sebaceous and sweat glands) are known to be appendages of the skin. Nails are the invagination of the outer layer of the skin, the Epidermis and composed of very small cells, called onychocytes, which are mainly made up of keratin, a fibrous protein. Human nail is composed of many parts like nail plate, nail bed, matrix, nail cuticle, eponychium, hyponichium, specialized ligaments and nail folds.

Nail Plate
Nail plate is the hard translucent, most visible and functional part sits on and covers the nail bed and composed of keratin. Proximally and laterally the nail plate is surrounded by the nail folds, which covers its proximal and lateral margins. The nail plate is more porous than skin, hence water can pass through it more easily than through the skin. The nail plate looks like a single solid piece but it is made up of 100 layers of dead, flattened cells which are arise from the germinal matrix epithelium of the nail bed. The pinkish color of the plate is due to blood capillaries below the nail plate, which receives blood supply from ulnar and radial digital arteries. The Free edge or distal edge is the anterior cutting margin of the nail plate that extends over the tip of the finger and toe.

Nail Bed
It is the living skin below nail plate or we can say that the area upon which the nail rests. It grows from the distal margin of

lunula towards the epidermis of hyponichium (free edge) and looks pinkish due to blood capillaries visible through translucent nail plate. Bed epithelium (a thin layer of tissue) is act as junction between nail bed and nail epithelium. Nerves are also present in the nail bed.

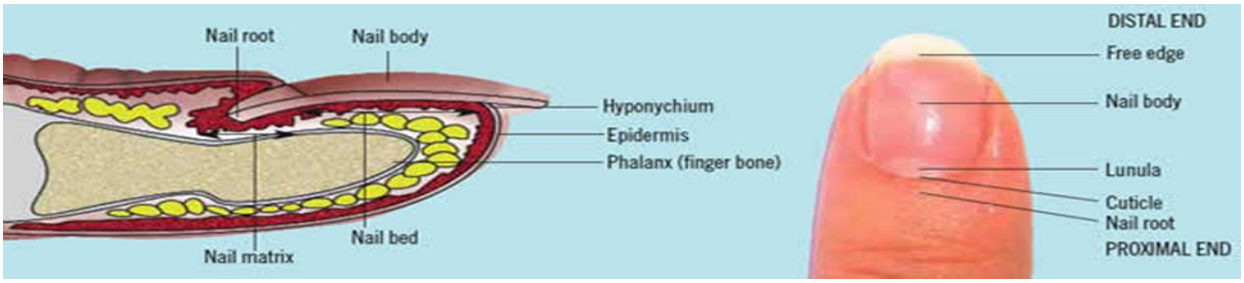

Fig 1: Nail Structure and Anatomy

Nail Matrix

The nail matrix is specialized epithelial structure that lies below the proximal nail fold. The nail matrix epithelium composed of basal cells which in turn differenciate into spinous cells and then into orthokeratotic cells that forms the nail plate. The nail matrix is also known as root of the fingernail. This portion composed most of the portion of the nail and the nail bed.

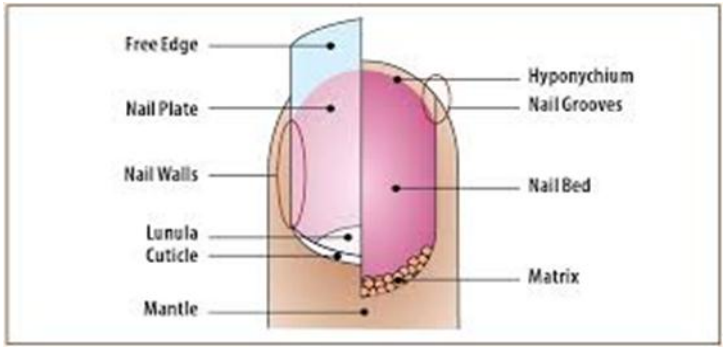

Fig 2: Nail Structure and Anatomy

Lunula

It is the whitish visible semicircle (Half-moon) part at the base of the nail plate. At this half-moon part, the nail bed is so tightly packed with keratin that the capillaries are masked by the amount of keratin. The lunula is largest in the thumb and often absent in the little finger.

Cuticle and Eponychium

Generally, Cuticle and Eponychium create confusion with each other. They are not same. The Cuticle is the dead skin (almost invisible) at the base of the finger nail or toenail and is often removed during manicure. But Eponychium is the living skin that is present at the base of the nail plate and covers the matrix area. Cuticle seals the space between nail plate and the skin. This sealing prevents the entry of foreign particle and micro-organisms and helps in avoiding injury and infection.

Hyponichium

It is the most distal, soft, slightly thickened layer of skin that is located between the fingertip and the free edge of nail plate and forms a water proof protective barrier that prevents micro-organisms from invading and infecting nail bed.

Nail Folds

These are the folds of normal skin that surrounds the nail plate and forms the nail grooves which furrows on the side wall. The side wall is also known as lateral nail fold which is the skin overlapping the side of the nail.

Specialized Ligaments

It is a tough band of fibrous tissue that attaches the nail bed and matrix bed to the underlying bone. These ligaments are situated at the base of the matrix and around the wedges of nail bed.

Functions of Nail

- A healthy nail protects the distal phalanx, the finger tip, and the surrounding tissues from the injuries
- It helps to enhance delicate movements of the distal digits through counter pressure exerted on the pulp of the finger
- The nail acts as a counterforce when the end of the finger touches an object and hence enhancing the sensitivity of the fingertip
- Without nails on the fingertips, it is not possible to grab and hold the things accurately or precisely.

Significance of Nails in diagnosis of various diseases

The appearance, color, shape and nature of the nails also tell about the health and hygiene of a person. Nails are examined routinely by the doctors to get some information about disease. The abnormality of the nails may give the indication of any normal to serious disease in a person. Hence, the

examination of the nails by the doctors is first and essential step to diagnose the disease. There are some abnormalities with probable causes which are discussed as follows:

1. **Personal Cleanliness (Hygiene)**
   Nails become unhygienic very easily specially in case of children. Dirt deposition takes place below the free edge (distal end) of the nail plate easily may enhance the chance of pathogen ingestion during eating. Hence proper nail cutting is essential especially in case of children. When the worms crawl in the anal orifice, children will scratch which lodges the ova of worms below the nails and will be taken in during eating. Sharp nails may cause a complicated skin disease by habitual scratching.

2. **Color of the Nails**
   - Absence of lunula may be the indication of anaemia, low level of cellular oxygen, poor circulation or malnutrition. A pale blue lunula may be the indication of diabetes mellitus
   - Blue coloration of lunula (azure lunula) found in Wilson's disease
   - In silver poisoning, nail turns blue-grey in color and in tetracycline therapy turns in yellow color
   - A red discoloration of the lanula may either indicate cardiovascular disease, collagen vascular disease or hematologic malignancy
   - Green nails may be caused by allergies from the cleaning agents, from bacterial and fungal infection
   - Blue nails indicate cyanosis, which is an inability of the body to supply oxygenated red blood to the extremities due to constriction of blood vessels in coldness. Blue or pale nails may also indicate the deficiency of iron (anaemia)
   - A blue color of nails may be induced by drugs such as Minocycline which may result in very small lunula, as well as cutaneous and mucosal discoloration due to dermal deposition of iron chelates
   - Yellow nails may be due to hypoalbuminaemia, lymphoedema, jaundice, diabetes mellitus, amyloidosis, median or ulnar nerve injury, from fungal infection, tetracycline drugs, rheumatoid arthritis
   - Nails of heavy smokers are also yellow/ Brown due to staining by nicotine, which is also called quitter's nails
   - Purple nails may be due to deprivation of oxygen and circulatory problems
   - Reddish-brown colored spots may indicate the deficiency of folic acid, protein or vitamin C

Tips to keep the nail Healthy

- Cut your fingernails and toenails properly i.e. straight across and slightly round in the centre. It keeps your toenails strong and also avoid the ingrown of toenails
- Clean and dry the nails properly to avoid bacteria and dust particle residing under the nail
- Sometimes toenails are thick and difficult to cut, deep feet in warm salt water (one teaspoon of salt per pint of water) for 5 to 10 minutes, then apply urea or lactic acid cream. It softens the nail and make them easier to cut
- Tight shoes may cause ingrown of toenails, so wear proper fitting shoes for avoiding ingrown of toenails
- Avoid self-treatment of ingrown nail, especially when they are infected and consult a dermatologist
- Avoid nail biting otherwise infectious micro-organisms transfer between your fingers and mouth. Nail biting can also damage the skin around your finger, permitting the infection to enhance
- Nail problems are more common in the persons with diseases like diabetes and poor circulation and they should consult a dermatologist at the first sight of the problem

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