

A REVIEW ARTICLE ON DRUG DELIVERY SYSTEM – A NOVEL APPROACHES FOR DRUG DELIVERY SYSTEM

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ABSTRACT

Nail drug delivery system (NDDS) is an important means of transport in mammals whose nails are largely affected by fungal conditions. Problems with the nail unit range from particularly inoffensive conditions similar as hyperpigmentation in heavy smokers to numerous painful and enervating conditions similar as nail unit dystrophy, hypertrophy, and infection. It's flexible hedge to penetration of topical medicines. As technology improves, there are changes that affect medicine delivery structures Given the eventuality for systemic adverse goods associated with traditional oral remedy, non-guaranteed options for

Onychomycosis is demanded. Are collecting to effectively treat nail problems, the applied tablet must access the thick keratinized nail plate and reach the deeper layers of the nail plate, nail bed, and nail matrix.

Physical, chemical, and mechanical strategies have been used to reduce the nail hedge. Onychomycosis and transungual medicine delivery continue to admit considerable attention from the need for effective topical treatments for onychomycosis given the implicit threat of systemic side goods associated with conventional oral curatives. To successfully treat nail problems, the fitted lozenge must access beyond the densely keratinized nail plate to reach the deeper layers of the nail plate, nail bed and nail matrix.

The nail plate is responsible for the penetration of medicines into it. It's hard enough that it's delicate to access, and at best it's a bit of a topical medicine that penetrates. thus, important mending attention is not perfect.¹

I. INTRODUCTION

The nail has wanton structure. Nail plate is responsible for penetration of medicine across it. As it is hard enough the penetration becomes delicate, only a bit of topical medicine penetrates across it. Hence effective remedial attention is not achieved. The nail plate may appear abnormal because of dropped gleam. Its involvement of nail bed, reduction of blood force, physical or chemical features of nail bed. As a result, a variety of conditions do.¹ These conditions can be cured by achieving asked remedial attention of medicine by nail medicine delivery system. mortal nails do not have only a defensive and ornamental part, but can also be considered as an indispensable pathway for medicine delivery, especially in nail conditions similar as onychomycosis or psoriasis. These nail conditions are extensively spread in the population, particularly among senior and vulnerable compromised cases.² Oral curatives are accompanied by systemic side goods and medicine relations, while topical curatives are limited by the low saturation rate through the nail plate. For the successful treatment of nails complaint the applied active medicine must percolate through the thick keratinized nail plate and reach deeper layers, the nail bed and the nail matrix. Studies conducted on mortal skin illustrated its structure, functions, and its permeability for some substances, but veritably little is known about skin derivate, nail, and the parcels of nail keratin. The purpose of this work is to ameliorate the understanding of physicochemical parameters that impact medicine saturation through the nail plate to treat not only topical nail conditions but also to consider the possibility to reach systemic rotation and neighboring target spots. The purpose of this review is to explore the difficulties in penetration of medicine across nail plate and improvement of bioavailability of antifungal medicine. The being clinical substantiation suggests that a key to Successful treatment of fungal conditions by topical antifungal products lies ineffectively prostrating the nail hedge. Current topical treatments have limited remedial effectiveness conceivably because they cannot sufficiently access in the nail plate to transport a therapeutically enough antifungal medicine to the target spots to annihilate protection. Also, the analysis of the medicine's penetration is a delicate task. The topical remedy of nail conditions, especially of onychomycosis, and to a lower extent, of nail psoriasis, is desirable to avoid the side goods associated with their systemic remedy, to increase patient compliance and reduce the cost of treatment. Systemic remedy is still the dependence of treatment due to the poor permeability of the nail plate to topically applied medicines. For effective topical remedy and fungal medicine saturation must be

enhanced. 3 This can be achieved by dismembering the nail plate using physical ways or chemical agents. Alternately, medicine saturation into the complete nail plate may be encouraged, for illustration, by iontophoresis or by formulating the medicine within a vehicle which enables high medicine partition out of the vehicle and into the nail plate. The physical ways (primer and electrical nail bruise, acid drawing, ablation by spotlights, microporation, operation of low- frequency ultrasound and electric currents) and chemicals (thiols, sulphites, hydrogen peroxide, urea, water, enzymes) that have shown unguaranteed enhance reactivity. The mortal nail can be tormented by several complaint countries including paronychia, psoriasis and infections due to bacteria, contagions, or fungi. Whilst infrequently life hanging, these induce tone- knowledge and cerebral stress.4 roughly 50 of all problems result from fungal infections, onychomycoses, and the frequency of these may be as high as in Europe and 10 in the United States. There are numerous treatments rules, but the most common involves oral dosing with antifungal agents similar as terbina forfeiture or itraconazole. Experimental ways for disquisition of the penetration and distribution of chemicals into and through the nail plate demonstrated that it's possible to deliver medicines to the nail following topical operation and led to the development of newer, more effective topical products and rules for treatment of onychomycoses and other nail conditions. A new ultrasound- intermediated medicine delivery system has been developed for treatment of a nailfungal complaint onychomycosis) by perfecting delivery to the nail bed using ultrasound to increase the permeability of the nail.

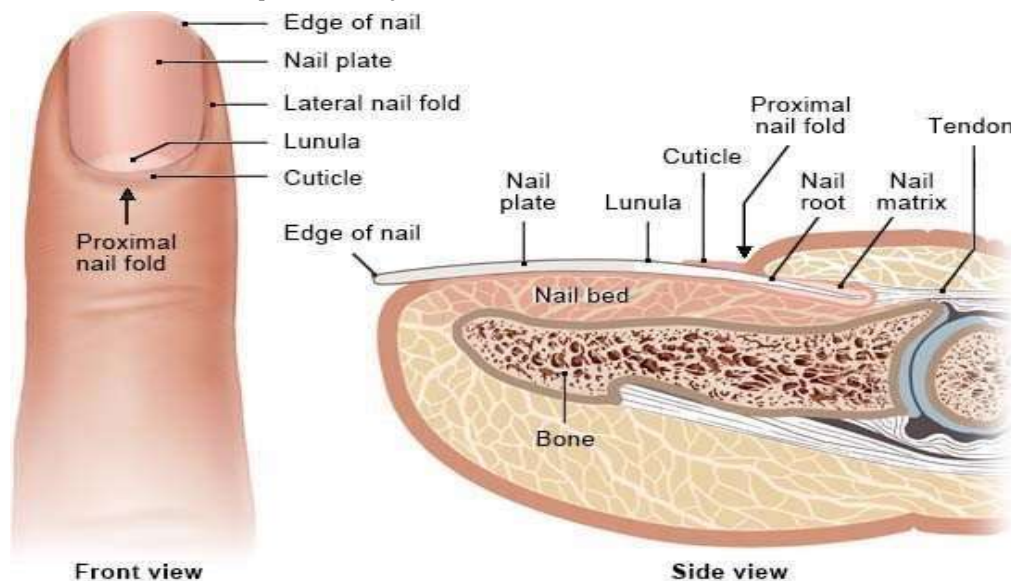


Fig 1: General Structure of Nail

II. ADVANTAGES

1. Preparation is easy compared to oral lozenge forms like tablets etc.
2. Possible bettered adherence.
3. For those who are unfit to take systemic drug.
4. Preferred in senior cases entering multiple specifics, to avoid medicine relations.
5. Systemic adverse goods are absent.
6. Systemic immersion is less and as it's a topical expression it can be fluently removed whendemanded.

III. DISADVANTAGES

1. Rash- related adverse goods analogous as periungual erythema and erythema of the proximal nail fold was reported most constantly. \
2. Other adverse goods which were allowed to be casually related include nail. Conditions analogous as shape change, vexation, in the grown toenail, and bruise.

3. It must be applied regularly until all the affected nail kerchief has grown out. This takes 9- 12 months for toenails and 6 months for toenails.

IV. MAJOR CHALLENGES

The nail face or plates are thicker and harder because of the stable disulphide bonds which will be confined to drug penetration in the nail. Implicit penetration of nail enhancers should be used to weep phrasings inside the nail barricade.

- It's essential to consider the physicochemical parcels of the drug patch, expression characteristics, relations between the drug and keratin and penetration enhancer when designing topical nail phrasings.
- In oral antifungal remedy, liver function tests must be performed regularly. Analogous antidotes are precious and hindered by or due to poor case compliance. thus, topical remedy remains the treatment of choice in this delivery system⁵.

V. OBJECTIVES

1. External operations lead to lower side goods.
2. Useful for beautification and as well as treatment.
3. Expression will be patient friendly.
4. Simpler ways are demanded for expression.
5. People won't feel like it's medicine.
6. This expression changes the view of medicine.

VI. NAIL ANATOMY

The nail is a one- of-a-kind barricade made up of several strands of keratin bound together by disulfide bonds that act like a hydrogel and have a feathery nature with a specific viscosity. The mortal nail is about 100 times lower in viscosity in comparison with the stratum corneum, making it the body's hardest boundary structure ^{5,6}. The aesthetic appeal of nails is also, significant. Unlike hair, fingernails grow at a constant rate of about 0.1 mm per day or 3 mm per month. Toenails develop at around half to one- third the rate of fingernails. A fingernail regenerates in 4 – 6 months, while toenails take 8- 12 months or longer to regenerate. Because of its structure, it has a defensive point. It's made up of 25 layers of fragile, dead, and keratinized cells, each measuring 0.01 mm in viscosity. The nail unit refers to the nail and its corridor as a whole ⁷. The plate of the nail grows from the matrix, arises from the crease of the proximal nail and is retained in place by the side nail crowds. The nail plate securities the nail bed from damage and separates from it at the hyponychium. It's discovered that the plate of nails is thin, elastic, rigid, transparent, and convex in form. Intercellular attachments, desmosomes, and membrane coating grains keep these cells complete ⁸. The low lipid content of the nail caste, along with its molecular composition of keratin molecules communicating across disulfide liaison gives it a hydrogel- suchlike behavior separating it from other body walls ⁹. The corridor of nail assembly is hyponychium, nail matrix, nail fold, nail plate, nail bed, and onychodermal band. Figure below.

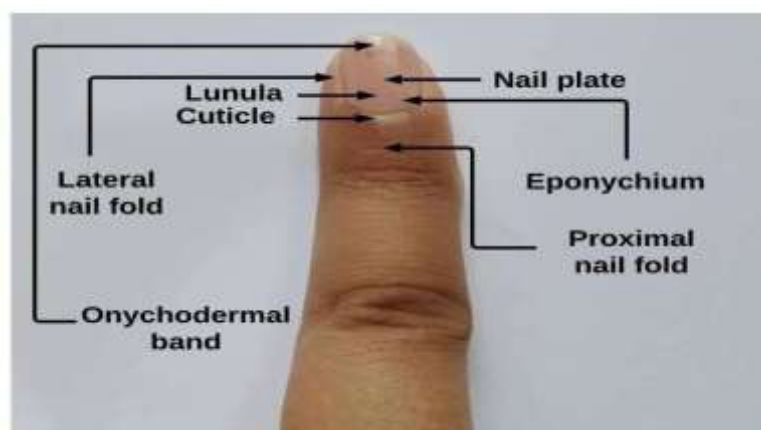


Fig 2: Structure of Human Nail Finger

1. Nail matrix and lunula (nail root)

The matrix of the nail is slightly the living element of the nail outfit, which consists of germinative epithelial kerchief whose cell division gives rise to the plate of nails. It's set up under the skin at the proximal tip of the nail 10. The apkins under the nail are separated into two groups the matrix(15- 25) and the nail bed(75- 85). In certain integers, the apex of the matrix is visible as the lunula. In certain cases, the crease of the proximal nail completely obscures it. The proximal element covers half of the space between the nail fold and the distal interphalangeal joint's central crease. Reardon recommends choosing a position 75 percent of the way to the distal interphalangeal joint as the position for this marker is necessary for nail unit excision 11. The lunula is a pale "halfmoon" that can be set up on the index croquette isless visible in the integers on the ulnar side. The matrix gives rise to all or much of the plate of the nail. On functional grounds it's realizable to produce a distinction between the distal and proximal matrix, it's said that in the nail plate, 50 of the proximal nail matrix contributes of the cell numbers 12.

2. Nail bed (ventral matrix and sterile matrix)

The bed of the nails is a truly thin epithelium to which the nail plate adheres and slides during its development 12. The nail bed runs from the lunula distal fringe to the hyponychium. A set of epidermal ridges that run the length of the skin extending to the lunula can be seen after the avulsion of the nail. A complementary series of ridges can be seen on the bottom of the plate of the nails, as a result, the nail was guided up the nail bed asif on track. The nail bed's bitsy Vessels are all aligned around the same axis. The nail bed is adorned with a low degree of proliferation and a keratin supplement that lacks the terminal Separation keratins, K1 and K10, set up in normal skin. The nail bed's dermis is spare, with slight fat, hard collagenous conformity to the underpinning periosteum, and neither sebaceous nor follicular accessories are present 11. In- vivo magnification allows near the nail bed's 11 distal edge sweat tubes have been seen.

3. Hyponychium

The hyponychium is the region under the free edge, where the nail plate begins to separate from the nail bed 4. A crack is formed by the hyponychiumand an stretched free nail. This is arepository for scabies, antigens, and microbes; it's significant in surgery and infection spread. It forms a protective seal around the nail bed.Rash-related adverse effects such as periungual erythema and erythema of the proximal nail fold were reported most frequently.

1. Other adverse effects which were thought to be casually related include nail. Disorders such as shape change, irritation, in the grown toenail, and discoloration.
2. It must be applied regularly until all the affected nail tissue has grown out. This takes 9-12 months for toenails and 6 months for toenails.

4. The cuticle (eponychium)

The proximal nail fold of the nail plate has an epidermal subcaste that reaches up to the rearward side 13. Cuticle failure makes the proximal nail fold's protective function more complex, indicating that the first hedge has been broken. Cuticle regrowth is a clear sign of a seditious process's resolution. Inflammation of the crowds of the nails and changes in the plate of the nail face are common side goods of manicures, and cuticle junking should be avoided.

5. Nail folds

Nail crowds, which are skin structures that enclose the nail plate at its side and proximal ends, are made up of crowds on the proximal and side sides. The cuticle stretches from the nail fold at the proximal end acting as a physical hedge against exogenous accoutrements entering the nail 4-Side nail crowds The gentled cutaneous side perimeters of the nail are made available with side nail crowds. In the toes, they're generally more common than in integers, which is associated with the help of their participation in the nail's strict adherence to the bed of the nail.Proximal nail fold- The nail fold of the proximal end is a skin lip formed during week 14 of embryogenesis where the nail's origin forms a fund on the number's dorsum. It adheres to the nail plate's rearward side and conceals the whole or a portion of the matrix of the nail, clinically known as the lunula. It joins with the plate of the nail to form a defensive coating over the matrix, which, if weakened, can beget endless nail scarring. This protection also includes UV protection to round natural UV protection handed by

the nail plate 14. The matrix is the onlsubungual position where functional melanocytes can be set up, and UV protection can help to minimize the threat of cancer. The proximal nail fold also works in tandem with the cuticle to form a hedge against annoyances, detergents, and other agents that could disrupt matrix function and, as a result, nail conformation.

6. Nail plate

The plate of the nail is the most visible portion of the nail outfit. It's a thin stratum(0.25 mm) conforming of around 25 layers of death, keratinized, and smoothed cells that are tightly bound to one another 15. The plate of the nail is a streamlined stratum corneum with a keratinized laminated structure that guards the nail matrix and bed. When studied histochemical with tableware stains, by optic consonance tomography, by ultrasound, and by electron microscopy, the laminated shape can be seen 16,17. While its physical features are compatible with abi laminar structure, it's generally allowed to betri-laminar. The frontal aspect of atri-laminar structure might have evolved by superficially glutinous material handed by the nail bed. This is handed as a reason for the rise in viscosity and consistence as it expands distally 18. It also has direct crests that match up with flattering crests on the nail bed to which it's clicked. Both the transverse and longitudinal axes of the plate of the nails are twisted. This causes it to be fitted in the side and proximal edges of the nail, furnishing good attachment and making the free edge a precious armament. Toes have further prominent characteristics than fingertips. The side perimeters of the matrix and nail around the terminal phalanx of the great toe stretch about half around it. This gives the bottom the necessary strength. The nail plate's upper face is flat, with an on-constant volume of crests that vary with age. The pack of the proximal nail side, which is nominated the lunula, is used as a reference structure to calculate the rate of growth of the plate of the nail 19.

7. Onychodermal band

The nail bed's distal edge, known as the onychodermal band, has a different color than the rest of the nail bed 20. This is generally a 1- 1.5 mm transverse band with a darker pink or brown color. It's color or appearance may change because of complaint or contraction, affecting vascular force. The onychocorneal band is the first line of defense against accoutrements piercing under the nail plate. In general terms, the matrix of the nail is responsible for the nail plate creation, abiding on the bed of the nail, and is framed and ensheathed by the nail crowds and the hyponychium 4,21.

VII. NAIL RELATED DISORDERS

Nail conditions range from saturation or abrasion to excruciating and crippling conditions performing in atrophy, inflammation, and brittle broken nails 22. Nail conditions regard for around 10 of all dermatological diseases are common among the senior 23. This high frequency is due to several reasons, including poor rotation and the presence of a habitual systemic condition(e.g., diabetes mellitus), lump, changes in bottom biomechanics, and a weakened vulnerable system 24,25. It's getting decreasingly clear that nails and systemic conditions are inextricably linked, and that nails can offer important individual hints for the underpinning pathologic complaint 25. Nail problems may harm a case's quality of life.

General problems include pain, trouble walking, difficulty wearing shoes, fear of spreading illness, and social demotion. The implicit to fete both natural and pathological variations in the nail allows for further effective care and opinion of these common issues. The proximal nail fold of the nail plate has an epidermal layer that reaches up to the dorsal side 13. Cuticle failure makes the proximal nail fold's defensive function more complex, indicating that the first barrier has been broken. Cuticle regrowth is a clear sign of an inflammatory process's resolution. Inflammation of the folds of the nails and changes in the plate of the nail surface are common side effects of manicures, and cuticle removal should be avoided.

Table 1: Nail Disorders and Symptoms

Nail Disorders	Characterization/Symptoms
Onychomycosis	<ul style="list-style-type: none"> • Onychomycosis is a fungal infection of the keratinized tissue of the nail plate. <ul style="list-style-type: none"> • Yellow-brown patches near the lateral border of the nail • The nail plate gradually becomes thickened, broken and irregularly distorted. <ul style="list-style-type: none"> • One or many nails may be affected.

<p>Psoriasis</p> <p>Onycholysis Leuconychia Pterygium</p>	<ul style="list-style-type: none"> • Raw, scaly skin • The nail plate becomes pitted, dry, and often crumbly and also appears red, orange or brown, with red spots in the lunula. <ul style="list-style-type: none"> • The plate may separate from the nail bed. • Division of the distal nail plate from the nail bed • It can occur in hypothyroidism, with chemotherapy and pellagra. <ul style="list-style-type: none"> • White spots or lines appear on one or more nails. • Pterygium of the nail is the presence of a scarred midline band originating from the proximal nail fold in the nail.
<p>Clubbing Tinea unguis</p> <p>Yellow Nail Syndrome Onychatrophia</p> <p>Onychogryposis Onychauxis Leuconychia</p> <p>Beaus lines Koilonychias</p> <p>Melanonychia</p>	<ul style="list-style-type: none"> • Clubbed nails show an increase in the longitudinal and transverse curvature of the nail. <ul style="list-style-type: none"> • Also known as ringworm of the nails • Nail thickening, deformity, and nail plate loss. • Nails are over curved, thickened, and opaque yellow to yellowish green. <ul style="list-style-type: none"> • Atrophy of nail plate • Loss of nail plate luster. • The nail plate becomes thickened nail plate. • The nail plate will curve inward and pinching the nail bed. • Brittle nails which often split vertically, peel and/or have vertical ridges. • Over thickening of the nail plate may be the result of internal disorders. <ul style="list-style-type: none"> • White lines or spot in the nails. • This condition may be hereditary. • Horizontal lines of darkened cells and linear depressions. <ul style="list-style-type: none"> • It is usually caused by iron deficiency anemia. • These nails show raised and are thin and concave. • It is a vertical pigmented band, often described as nail 'moles,' which usually forms in the nail matrix.

1. Onychomycosis

Onychomycosis is a fungus that attacks the nails. Dermatophytes, provocations, and molds are responsible for the infection. Our nails, hair, and skins are more vulnerable to dermatophyte fungi, which are liable for over 80 fungal infections. Onychomycosis is a nail fungal infection that affects 10- 40 of the population. Inheritable predilection to onychomycosis, diabetes mellitus, and nail injury, as well as a suppressed vulnerable system, are the most likely causes. Inordinate sweating, ill-befitting socks, and wet bases are all aggravating factors. Thickening, abrasion, and cracking of the nails are all symptoms of fungus infections, which beget inflammation and pain. Four distinct forms of onychomycosis result from colorful fungi overrunning themselves in different ways.

- Distal side subungual onychomycosis Fungi spread via the distal subungual area, hyponychium, and side nail groove. The nail plate develops unheroic longitudinal lines, and the nail bed thickens or hardens in numerous cases (hyperkeratosis).
- Proximal subungual onychomycosis Infection in the proximal nail plate caused by penetration from the nail proximal crowds or nail cuticle is the least common form. It has a distinctive particularity of change in color of the nails as white stripes that appear close to the fold of nails and can spread to other areas over time.
- Superficial onychomycosis By infecting the nail plate's rearward face, it's substantially limited to toenails. White stripes or specks appear on the nail subcaste, which frequently becomes further brickle and powderier in texture.

- Endonyx onychomycosis- Infection by a fungus that enters the nail plate through the free periphery, causing a milky white mark and leaving the nail plate opaque. In this form of infection, between the nail bed and the nail plate, there's no separation or thickening (hyperkeratosis) 15.



Fig 3:

2. Paronychia

Inflammation of the side and proximal nail folds is caused by this infection. It may be acute or habitual. Staphylococcal bacteria beget the acute type, which damages the cuticle and nail folds, causing discomfort and inflammation. Inconvenience responses to environmental pollution or alkali induce habitual paronychia. The nail fold swells, creating ideal conditions for growth of common bacteria, aggravating the complaint 26.



Fig 4:

3. Nail psoriasis

Psoriasis is a skin condition characterized by raised red patches that beget inflammation and discomfort. The nail matrixes have pitting and deep transverse furrows, while the bed of the nail having distinctive unheroic-red nail abrasion that looks like a drop of blood or oil painting beneath the plate of the nail and leads to skin thickening underneath the nail. The nail plate's hardness and pliantness were lost, performing in the nail loosening, and cracking 26.



Fig 5:

4. Nail plate overgrowth (onychogryphosis)

It's normal in the senior due to their failure or lack of hygiene or nail trimming. It allows the plate of the nail to cake and coil, giving it a 'claw-shaped' appearance. Thickened nails can cause discomfort by pinching the skin. Subungual hemorrhage may arise because of inordinate trauma, particularly if you have supplemental vascular complaint or diabetes 26.

**Fig 6:**

5. Spoon nails (Koilonychias)

It's a condition that allows the nail's free edge to come everted, like a ladle. It affects a large number of children. Nail- smelling causes several transverse grooves on the nail plate and coldcontact causes blue- and-white fingertips from Raynaud's complaint or related collagen vascular diseases. Some nail diseases include leuconychia, which causes white stripes or stripes on the nail because of trauma. Brittle and rough nails that tear snappily or frequently cut vertically are symptoms of an infection known as onychorrhexis. Onychotrophia is specified by nail plate atrophy 27.

**Fig 7:**

6. Pseudomonas bacterial infection

This can be between the nail bed and nail plate, as well as between an artificial nail subcaste and the nail plate. The classic 'green' abrasion of this form of infection has led numerous people to suppose it's earth. earth, in reality, is n't a mortal pathogen 28. The abrasion is caused by iron composites and is a by- product of the infection. Pseudomonas thrive in wet surroundings, where it feeds on dead towel and bacteria in the plate of the nail while allowing it to expand. The nail plate will darken and weaken under an artificial coating for this infection. The finer the abrasion, the deeper the bacteria have entered the nail plate membranes. The same contusions will do if the bacteria enter between the nail bed and the nail plate, and the nail plate can indeed rise from the nail bed 29.

**Fig 8:**

7. Fungal or yeast infection

Onycholysis (nail plate separation) is a symptom of this infection, as is visible debris below the plate of the nail. It's generally pale unheroic and also changes seen in the shape and structure of the nail. The nail plate is made up of keratin protein, which the fungus abridgments. Chemical material accumulates beneath the nail plate as the infection spreads and changes in the nail color takes place. Involvement of other contagious agents may be there, and if not treated duly, the nail plate could detach from the nail bed 30.



Fig 9:

8. Tinea unguis

It's the nail ringworm and is marked by deformation, thickening of the nail, and eventually performing in nail plate amputation 31.



Fig 9:

9. Onychatrophia

Onychatrophia is the loss of luster, shrinking, and sometimes complete shedding of the plate of the nail. This nail irregularity may be because of an injury or a complaint 31.



Fig 10:

10. Onychogryposis

Onychogryposis is a condition characterized by claw- suchlike nails with nail plate thickening that is substantially the product of trauma 32. This kind of plates of the nail will bend overhead, pinche the bed of the nail, and surgical action is needed some time to ease the discomfort.



Fig 11:

11. Onychorrhexis

Brittle nails with longitudinal splits, shelling, and/ or perpendicular crests are known as onychorrhexis. This irregularity in the nail may be because of heredity, also the use of heavydetergents in the plant or at home, similar as ménage cleaning results. While treatments withoil painting or paraffin will hydrate the nail plate 33.



Fig 12:

12. Leuconychia

It appears as white marks or stains on the nail plate and is produced by bitsy bubbles of airwedged in the nail plate subcaste because of trauma. This complaint may be inherited and there's no need for drug because the spots will fade with the expansion of the nail plate 31.



Fig 13:

13. Beaus lines

Nails with vertical lines of darkened cells and direct depressions are shown in this situation. This complaint is aggravated by some dislocation in the protein product of the nail plate maybe because of accident, sickness, starvation, or any significant metabolic condition, chemotherapy, or other dangerous events 34.



Fig 14:

14. Hematoma

It occurs due to the destruction of the nail plate. That can be anything from catching a cutlet or toe in the auto door to rubbing from ill- befitting or too tight shoes to a sporting accident. A hammer can also spark hematoma! Owing to the damage, e, the nail bed will bleed, and the blood will get stuck between the nail bed and the nail plate. A hematoma may also be a sign of a broken bone. Because of the inordinate rubbing between the shoes and the toenails, numerous People who engage in athletic events develop hematomas. Since blood attracts fungi and bacteria, hematomas, can affect in nail plate fragmentation and infection. If the clotting of blood becomes sore for several days; the nail plate can need to be removed so that the nail bed can be sanctified 35.



Fig 15:

15. Melanonychia

Melanonychia are painted perpendicular bands that develop in the matrix of the nail and are substantially appertained to as " nail intelligencers". An unforeseen shift in the plate of the nail may indicate the presence of nasty carcinoma or a lesion. Dark spots are a fairly common particularity in people with dark skin 35.



Fig 16:

VIII. FACTORS AFFECTING BARRIERS IN DRUG DELIVERY

1. Size of diffusing molecules

Medicine penetration into the nail plate is equally commensurable to molecular size. prolixity will be harder through keratin network as molecular size increases 38.

2. HLB value

As the lipophilicity of a substance increases, the permeability measure decreases to a certain stage, after which a rise in lipophilicity results in an increase in saturation in the nail. Though, pure alcohol's permeability measure will be five times lower roughly than adulterated alcohol. In the case of waterless expression, nails swell water and are trapped into the nail plate. As the keratin network expands, it causes larger pores to form, allowing prolixity of the motes more fluently 38.

3. Degree of ionization

Ionic composites are less passable to nail plates than their non-charged counterparts with permeability portions 39.

4. Nature of vehicles

Water hydrates the nail subcaste, causing it to swell. Assuming the nail plate or bed is a colloidal gel, swelling causes an increase in the distance between keratin filaments, lesser pores through which percolating moles will diffuse, and hence increased patch saturation. medicine immersion into the nail plate should reduce by substituting water with a nonpolar detergent that doesn't wet down the nail 40.

5. Presence of dorsal layer

Lapping cells are the most effective hedge to medicine perforation between the nail layers. medicine permeability improves when the subcaste is fully removed, similar as by chemical drawing and debridement with 30- 40 percent phosphoric acid or the operation of the enzyme keratinolytic 41.

6. Effect of nail constituents during drug binding

Keratin is considered to have a saturation indicator of about 5, meaning it's positive and negative charge at pH situations below and above this. As a result, depending on the charge of the moles, they can bind or repel them. This may explain why ionic composites have a lower nail permeability. medicine list to keratin lowers permeant vacuity, lessens the attention grade, and therefore restricts deep penetration 41.

7. Formulation effect

Weak acids and bases' degree of ionization is affected by pH, which reduces the permeability of these acids and bases through nail plates. It has an effect on their solubility in medication, partitioning into the nail subcaste, and relations with keratin. Hydration of the nails, the solubility of medicines in the expression, and medicine cube on the nail plates is all affected by the detergent. DMSO increases permeability 41.

IX. DIAGNOSTIC TOOLS FOR NAIL DISORDERS

1. Nail biopsy

The nail biopsy is a valuation system for determining the cause of a clinically unclear nail complaint that is n't diagnosed by experience, individual criteria, or usual mycology 42. Nail biopsy not only gives individual, prognostic, and etiologic detail but also helps in the analysis of pathogenesis of nail complaint 43. Nail biopsy is particularly helpful in treating psoriasis, lichen planus, longitudinal melanonychia, trachyonychia, and nail excrescences 44. It's used in onychomycosis opinion when the culture yield or bitsy of fungi is poor, frequently after repeated slice 45. A nail biopsy aims to make an accurate opinion of nail pathology with a quick, safe surgical procedure while precluding pain or discomfort 42. For every case, nail biopsy is n't obligatory. But when needed there are certain necessary preconditions to be gratified.

2. Methods

Punch biopsy, excision biopsy, longitudinal biopsy are all styles for nail biopsy. Any anatomical portion of the nail unit, similar as nail fold, nail bed, nail plate, matrix, can be penetrated with excision or a punch biopsy. Longitudinal nail biopsy provides the most histopathological detail but is n't generally used due to the threat of scarring. A common system of nail biopsy along with point to be biopsied for nail related diseases was collected in Table

1. Grounded on the position where it's being drawn from, nail biopsy can be classified as follows-

1) Nail plate biopsy

The simplest and least painful procedure is nail plate vivisection, which involves separating a portion of the nail plate(onycholysis or not) and transferring it for Histopathologic study 43. It provides inadequate histopathological information but is helpful in cases of nail psoriasis, onychomycosis, and knobs. The use of nail plate vivisection in systemic illness has also been delved completely 46.

2) Nail bed biopsy

Nail bed vivisection is used to separate between two or further diseases that have a common clinical patterns, similar as subungual hyperkeratosis or onycholysis, stain in the nail bed, or other painful nail bed injury. It may be a punch vivisection or elliptical excision(longitudinally acquainted). The recovery of nail bed after surgery is generally uneventful, and the circumstance of scarring and onycholysis are rare 42. In cases of nail bed excrescences, similar as glomus excrescences, a nail bed vivisection may be helpful 47.

3) Nail Fold Biopsy

Nail fold vivisection can be performed on the side or proximal nail crowds region, and is used to diagnose nail fold inflammation, benign or nasty excrescences in the nail crowds, and paronychia dermatoses, it may be a punch and shave vivisection, elliptical excision or enbloc excision(only proximal nail fold) 48. To avoid accidental injury to the underpart of the nail bed or matrix, a nail spatula should be fitted under the concerned pack before any excision.

Table 2: Location and methods of nail biopsy for nail-related disorders

Sr. No	Disease Conditions	Region to be biopsied	Methods of biopsy
1.	Suspected onychomycosis (lateral and distal subungual onycholysis, subungual or Total dystrophic onychomycosis)	Onycholysis nailplate	Nail plate biopsy
2.	Onycholysis, subungual hyperkeratosis	Hyponychium	Nail bed biopsy
3.	Leukonychia	Intermediate matrix	Nail matrix bed
4.	Splinter hemorrhages, salmon patch, onycholysis	Nail bed	Nail bed biopsy
5.	Beau's lines, pitting and eonychorrhaxis	Proximal matrix	Nail matrix bed

X. LACQUER FORMULATION

Formulating a nail lacquer for drug delivery involves several key components and steps to ensure effectiveness, stability, and patient compliance. Here is an overview of the formulation process:

Key Components

1. Film-Forming Agents

Polymers Common choices include nitrocellulose, ethyl cellulose, or acrylates. These form a film that adheres to the nail.

2. Solvents

Organic Solvents: Solvents like ethyl acetate, butyl acetate, or isopropyl alcohol are used to dissolve film-forming agents and enhance drug solubility.

Water: Water-soluble formulations may include water to improve patient comfort and reduce toxicity.

3. Active Pharmaceutical Ingredient (API)

The drug intended for treatment (e.g., antifungal, anti-inflammatory). The choice depends on the target condition.

4. Plasticizers

Additives like dibutyl phthalate or camphor improve flexibility and durability of the film.

5. Colorants and Additives -

Colorants: Optional, for aesthetic appeal.

Preservatives: To prevent microbial growth and enhance stability.

6. Enhancers

Chemical penetration enhancers (e.g., DMSO, oleic acid) can be added to improve drug absorption through the nail.

Formulation Steps

1. Selection of Ingredients -

Choose appropriate film-forming agents, solvents, and active ingredients based on the desired characteristics.

2. Dissolution and Mixing -

Dissolve the film-forming agent in the solvent under controlled conditions. Add plasticizers and any penetration enhancers.

3. Incorporation of the API -

Add the active ingredient to the mixture, ensuring it is well-dispersed and dissolved.

4. Homogenization -

Mix thoroughly to achieve a uniform formulation, which may involve using high-shear mixing or ultrasonication.

5. Adjustment of Viscosity -

Modify viscosity as needed to ensure optimal application. This can be done by adjusting solvent ratios or adding thickening agents.

6. Filtration and Packaging -

Filter the formulation to remove any undissolved particles. Package in air-tight, light-resistant containers to maintain stability.

Stability Testing

Conduct stability tests to assess the formulation's shelf-life, ensuring that

XI. CONCLUSION

Although lately our understanding of nail medicine transungual delivery system and nail permeability parcels have boosted vastly, yet important information is unknown like the unique fine microstructure of the nail plate, a structural fine model for prognosticating nail delivery, and medicine- keratin list parcels. diseases of the nails are common and they can be enervating and impact the case's capability to walk and perform conditioning. opinion in utmost cases are verified on physical examination alone. The simplest and least painful procedure is nail plate biopsy, which involves separating a portion of the nail plate (onycholysis or not) and transferring it for Histopathologic study 43. It provides inadequate histopathological information but is helpful in cases of nail psoriasis, onychomycosis, and knobs. The use of nail plate biopsy in systemic illness has also been delved completely 46. It appears as white marks or stains on the nail plate and is produced by tiny bubbles of air stuck in the nail plate layer because of trauma. This disease may be inherited and there is no need for medication because the spots will fade with the expansion of the nail plate 31.

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