Review Article

Aging of the Nail

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Abstract

The structure and functions of the normal nail have been described. The nail growth rate slows with aging. Macroscopically, the longitudinal streaks on the nail plate surface become increasingly conspicuous. Elderly persons often experience toenail deformities, which are all pathological changes. Nail diseases of high incidence include onychomycosis, pincer nails, and onychogryphosis, all of which reduce QOL (Quality of Life). Appropriate treatment should be administered.

KEY WORDS: normal nail, senile nail, onychomycosis, ingrown nail, onychogryphosis

Introduction

The structure and functions of the normal nail are first described, followed by an overview of nail aging and nail changes that are commonly found in the elderly.

1. The normal nail

1) Anatomy and physiology

Located on the back of each digit, the nail serves as a protector of the finger/toe tips. The structure and parts of the normal nail are shown in Fig. 1. The nail plate is formed by the nail matrix and extruded distally on the nail bed. Water is supplied from the nail bed to the nail plate, keeping the nail plate transparent. In the distal nail plate, however, water is no longer supplied from the nail bed, and the nail plate opacities at the free edge of the nail plate. Eponychium (cuticle) is formed and is added from the posterior nail wall to the nail plate surface. A positional shift of the free edge of the posterior nail wall changes the thickness of the nail plate, resulting in the formation of lateral grooves on the nail plate surface. On both sides, the corneum of the nail wall skin and the corneum of the nail plate come into close contact with each other, bringing the nail plate into close contact with the nail bed. Hence, the linkage between the nail plate and the lateral nail wall serves as an anchor to fix the nail plate on the back of the digit. Viewing the nail plate from back, a milky white lunule is found on the base, which corresponds to the nail matrix.

In human adults around the age of 20, the nail plate gains about 0.1 mm in length a day. The nail plate continues to gain in length throughout the lifetime. Regarding fingernail plate thickness, the thumb nail plate is the thickest but is at most about 0.7-1.0 mm. The little finger nail plate is 0.3-0.5 mm thick. On the nail plate surfaces are thin longitudinal streaks; they are the most inconspicuous around 20 years of age, and become increasingly conspicuous with aging.

2) Roles

While defining the shape of the digital tip, the nail plate protects the digital tip by lessening the trauma to the digital tip. Clipping nails too deep can produce small injuries in the fingertips, causing hand chapping. The presence of the nail plate makes it possible to do detailed tasks by fingertip actions, including picking up a thin needle from the floor and opening a pull-top can. Because the distal phalanx is present only to the midway of the distal phalanx of the digit, and is narrower than the nail plate, the nail plate supports the force on the digital flexion side at portions where the distal phalanx is absent. This makes the finger pulp sensitive in touch, making it possible to do detailed tasks. Some persons cut the lateral margins of the nail plate short. In such cases, the linkage between the nail plate and the lateral nail wall is broken so that the nail plate is no longer able to support the force on the finger flexion side, resulting in retroflexion of the nail plate. This is koilonychia.

Since short nail plates can lead to fingertip deformities, it is readily understandable that the nail plate adjusts the shape of the fingertip. Additionally, short nail plates can cause fingertip cracks along the lateral nail grooves in the thumb and elsewhere. In the great toe, cutting a nail to the quick can cause ingrown nails. The nail plate can also help scratching itchy skin and work as an offensive weapon.
2. Aging of the nail

The normal nail continues to gain in length with almost no change in appearance throughout the lifetime. Histologically, a report is available on slight degeneration of elastic fibers in the nail bed dermis \(^2\). The nail plate growth rate decreases slightly with aging \(^3\) (Table 1). Longitudinal streaks are found on the nail plate surface, and they become slightly conspicuous with aging \(^4\) (Table 2).

3. Nail deformities prevalent in the elderly

Even in the elderly, the fingernails are usually normal, whereas the toenails are often deformed. Therefore, toenail deformities commonly found in the elderly are not due to aging, but are of pathologic nature. Representative nail diseases in the elderly are described below.

1) Onychomycosis

Onychomycosis is a disease that often develops secondary to tinea pedis, and is prevalent in the elderly. It is characterized by the main symptoms of nail plate opacity and thickening (Fig. 2). A cure can be achieved by oral administration of 125 mg of terbinafine daily for 6 months or by drug pulse therapy withitraconazole.

2) Ingrown nails \(^5\)

This abnormality is likely to occur in the great toe. It is caused by the nail clipping practice where the nail plate is cut much shorter than the tip of the great toe. It is also observed in non-elderly persons, and is sometimes complicated by pincer nails. The tips of the lateral margins of the nail plate can damage the soft tissue around it, causing inflammation, swelling, and pain. Although wedge resection and phenol corrosion, which are methods of removing the lateral margins of the nail matrix, are practiced worldwide, these should be avoided because they leave deformities. Among many other therapies reported to date, the most reasonable is the one that uses the artificial acrylic nails to lengthen the short-cut nail plates.

3) Pincer nails

Pincer nails are nail deformities which are painful due to excessive inward curvature of the nail plate (Fig. 3). This is

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Table 1     Fingernail growth rate
(mean for 10 fingers during 10 days, mm)

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Male subjects, N</th>
<th>Male growth rate</th>
<th>Female subjects, N</th>
<th>Female growth rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 years</td>
<td>36</td>
<td>0.860</td>
<td>34</td>
<td>0.846</td>
</tr>
<tr>
<td>20 years</td>
<td>30</td>
<td>0.942</td>
<td>34</td>
<td>0.920</td>
</tr>
<tr>
<td>30-39 years</td>
<td>46</td>
<td>0.921</td>
<td>42</td>
<td>0.902</td>
</tr>
<tr>
<td>50-59 years</td>
<td>36</td>
<td>0.914</td>
<td>32</td>
<td>0.801</td>
</tr>
<tr>
<td>60-69 years</td>
<td>31</td>
<td>0.721</td>
<td>33</td>
<td>0.713</td>
</tr>
<tr>
<td>70-79 years</td>
<td>34</td>
<td>0.669</td>
<td>32</td>
<td>0.664</td>
</tr>
</tbody>
</table>


Table 2     Longitudinal striation of the nail

<table>
<thead>
<tr>
<th>Striation rating</th>
<th>Male Left thumb nails</th>
<th>Male Right thumb nails</th>
<th>Female Left thumb nails</th>
<th>Female Right thumb nails</th>
</tr>
</thead>
<tbody>
<tr>
<td>1+</td>
<td>55.8%</td>
<td>55.8%</td>
<td>55.8%</td>
<td>55.8%</td>
</tr>
<tr>
<td>2+</td>
<td>44.2%</td>
<td>44.2%</td>
<td>44.2%</td>
<td>44.2%</td>
</tr>
<tr>
<td>1+</td>
<td>65.2%</td>
<td>65.2%</td>
<td>65.2%</td>
<td>65.2%</td>
</tr>
<tr>
<td>2+</td>
<td>34.8%</td>
<td>34.8%</td>
<td>34.8%</td>
<td>34.8%</td>
</tr>
<tr>
<td>1+</td>
<td>59.8%</td>
<td>59.8%</td>
<td>59.8%</td>
<td>59.8%</td>
</tr>
<tr>
<td>2+</td>
<td>40.2%</td>
<td>40.2%</td>
<td>40.2%</td>
<td>40.2%</td>
</tr>
<tr>
<td>1+</td>
<td>75.6%</td>
<td>75.6%</td>
<td>75.6%</td>
<td>75.6%</td>
</tr>
<tr>
<td>2+</td>
<td>24.4%</td>
<td>24.4%</td>
<td>24.4%</td>
<td>24.4%</td>
</tr>
</tbody>
</table>

often associated with the wearing of pointed footgear. In the elderly, pincer nails are likely to occur because they are unable to exert a force on the flexion side of the great toe while walking due to foot deformities and the like. Provided that the nail plate retains elasticity, pincer nails can be corrected by the VHO method, wire method and the like. In severe cases, however, correction using artificial acrylic nails is recommended.

4) Onychogryphosis

Onychogryphosis refers to the state in which the nail plate is thick, hard, and opaque, with surface deformities in the form of oyster shells or goat horns. Because the nail plate is apart from the nail bed, it allows a string to be passed under it (Fig. 4). Although this deformity often develops in the great toe, it can occur in other digits.

If the nail plate falls off due to trauma and the like, if the patient undergoes surgery by a physician to remove the nail plate, or if the person himself or herself cuts the nail plate too short, the absence of the nail plate in the toe tip can produce an elevation in the tip of the great toe due to the force on the toe flexion side. As a result, nail plate growth is interfered, resulting in onychogryphosis.

In daily life setting, onychogryphosis in the great toe causes pain in the great toe while the patient is wearing shoes, reducing QOL. In the young, it also represents an aesthetic problem. In the elderly, removing the thickened nail plate using nail clippers allows them to wear shoes, which represents an improvement in QOL. Use of Liston nail clipper forceps (nipper nail clippers) makes it easy to cut the nail plate. Radical therapy is performed for young patients.

5) Corneum thickening (callus) of tips of second toes and nail plate thickening

In persons with long second toes (Greek type), poor choice of shoes and bad practice of wearing shoes can compress the tips of the second toes against the inner faces of the shoes, resulting in corneum thickening in the tips of the second toes, which in turn interferes with nail plate growth. In wearing a pair of shoes,
it is important that the shoestrings be tied firmly to prevent the feet from sliding forwardly in the shoes and prevent the inner faces of the shoes and the tips of the second toes from abrading each other.

4. Nail issues in the elderly

Many elderly persons are unable to clip their own toenails due to obesity, chronic disease, or grip strength reductions. This lengthens the toenail plate to the extent of covering the toe tip; in some cases, the nail plate tip damages the foot/toe skin. In addition, many people have a bad practice of clipping nails. Because the nail is an organ that protects the fingertips and toe tips, it is not good to clip it shorter than the digital tip, and it is even worse to cut the lateral margins of the nail plate short. This can produce ingrown nails and induce bacterial infections. Many others have poor choices of shoes and improper manners of wearing shoes, which can cause deformities of the toes and toenails. It is necessary to provide education on how to clip nail plates correctly, i.e., avoiding cutting the lateral margins of the nail plate shorter than the toe tip.

Conflict of interest statement

The author declares no financial or other conflicts of interest in the writing of this paper.

References

2) Lewin, K: The normal finger nail, Br J Dermatol. 77; 421-430:1965
5) Higashi H: The structure of the nail and the roll of the nail plate—With a focus on the great toe. Kutu no Igaku, 24; 155-160: 2010 (in Japanese)