

Brittle nails, fragile nails

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Introduction

This issue of J Cos Derm carries two magisterial reviews of brittle/fragile nails†, one by Robert Baran and Douglas Schoon (pp. 131–137) and the other by Antonella Tosti's group (pp. 138–144).

Two syndromes of nail fragility are so common in contemporary London practice as to be almost a normal finding.

Atopic brittle nails

The most common syndrome of brittle nails is that which favours atopic subjects with constitutionally fine nails which are exposed to above average wear and tear, especially if nail repair is slowed for any reason, most commonly nutritional insufficiency of women (in which dietary replacement is insufficient to replace menstrual and/or pregnancy loss). The result of this form of brittle nails is lamellar peeling of the free edge (onychoschizia) (see Fig. 4 on p. 133 and Fig. 1 on p. 134). Onychoschizia-type brittle nails are often (perhaps usually) a manifestation of xerosis. Brittle nails of this onychoschizia type are so common that they are found in 1/3 of adult women's fingernails^{1,2} and also sometimes in men and in the toenails of infants.³

†*Fine words.* Brittle nails can be regarded as synonymous with fragile nails. In English, the words fine and thin can be regarded as synonymous when applied to glabrous skin or nails, but not hair. Fine hair refers to the dimension of the individual hairs and is characterized by a narrow hair shaft diameter. Thin hair refers to hair density and is characterized by a low number of hairs/cm².

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Brittle nails of the onychoschizia type often form part of a wider syndrome, dubbed the *atopic keratin weathering syndrome* (AKWS).⁴ AKWS is characterized by onychoschizia-type brittle nails, radial fissuring of the fingerpulp, fissures at the distal edges of the lateral nail folds, radial fissuring of the heels, chapping of the knuckles and lips, split ends in the hair and sometimes there is generalized xeroderma, especially in winter. Such patients are usually atopic, and if not overtly atopic they are latently atopic often with keratosis pilaris, hyperlinear palms and frequently a family history of atopy.

Age-related brittle nails

The second most common form of nail brittleness is age-related nail brittleness. This is characterized by longitudinal ridging and, in due course, longitudinal splitting, which begins at the free edge and extends proximally (onychorrhexis) (see Fig. 1 on p. 132 and Fig. 1 p. 139).² It also is aggravated by wear and tear and/or nutritional insufficiency. It is first detectable in the thirties and becomes symptomatic in the forties or fifties as the originally smooth camber of the nails becomes gradually and increasingly corrugated, the smoothness giving way to longitudinal ridges, the crests of which are especially vulnerable to weathering.

Brittle nail pathophysiology

A dynamic equilibrium exists between wear and tear on the one hand and repair on the other. Nails deteriorate if wear and tear increases or repair slows. Nails improve if wear and tear diminishes and repair is optimal.

A third factor is also relevant. This refers to the genetically determined constitutional characteristics of the nail – its genotype.

Thus, these three factors of wear and tear, repair rate and nail genotype are the factors which determine the

health and strength of the nails. Impairment of any of the three can result in weakened fragile/brittle nails.

Constitutional nail thickness (i.e. nail genotype)

Skin can be constitutionally thick or thin. Thin (i.e. fine) skin is translucent. Objectively, its thinness can be measured using skin callipers or ultrasound. People with fine skin often have fine hair and fine nails. Just as fine hair is more vulnerable to weathering and can readily develop split ends, so also are fine nails more vulnerable to weathering, which is seen as onychoschizia.

Fine skin retains epidermal moisture less well than does thick skin. Fine skin therefore readily becomes dry skin. Any factors which disfavour epidermal humidity will make fine skin become dry.⁵

Nail weathering (i.e. nail wear and tear)

Dry skin is particularly susceptible to wear and tear. Modern living, with central heating and air-conditioning, tends to dehumidify ambient air which then dries the skin and mucous membranes. The frequent washing of modern life further dries the skin. All these factors tend to disfavour epidermal humidity. When the nail becomes dry, it becomes less pliable and therefore more brittle. The situation is worse in winter, as cold air carries less moisture than hot air and then the cold air is further dried out by modern central heating. Xeroderma and nail brittleness result.

Water contact paradoxically dries the nails (and the rest of the skin). This is seemingly despite (but is actually because of) the way in which water contact has an immediate and short-lived effect of increasing the water content of the nails (which temporarily renders them more pliable and easier to clip). On removing the nails from water, the increased water content of the nails quickly evaporates and with it are dissolved out some of the hygroscopic substances that enable nails to retain water in the first place. From that moment on, therefore, the free edge of that nail will contain less water than hitherto. So it will be drier, less pliable and more brittle.

Wear and tear also results from many other everyday activities and tasks. Using nails as a lever, contact with soap, detergent, spirit, nail varnish remover and even contact with paper can all weather the nails.

Nail regeneration (i.e. nail repair)

Physiologically, the epidermis is one of the most rapidly dividing structures of the body. Impairment of tissue turnover will be more quickly and disproportionately evident in rapidly dividing structures, including the nails.

An obvious example of diminished cellular turnover occurs with almost all anti-cancer chemo- and immuno-therapy. This influence is not seen with the first pulse of treatment, since a small diminution in regeneration may pass unnoticed, being still within the capacity of the nail to cope. On the other hand, prolonged or repeated reduction in nail growth will become evident as accelerated weathering of the nails, even with very small exposure to wear and tear. Homologous changes occur in other parts of the epidermis, for example chemotherapy-induced xerosis.

A more subtle but much more common cause of reduced nail growth is nutritional insufficiency of women (insufficient dietary replacement for menstrual and/or pregnancy loss). In London, this is extraordinarily common in menstruating young women or women who have had two or more children, as it is unfashionable for English women to eat red meat or liver. Rarely, a similar state may exist in men or women who are vegetarians and/or suffer from haemorrhoids or dyspepsia or who often take non-steroidal anti-inflammatories. A useful proxy of nutritional insufficiency is sideropaenia. The best test for this is iron saturation (iron/total iron binding capacity; or iron/transferrin) which is expressed as a percentage. Less than 20% means iron deficiency. (Ferritin is a less good test of iron deficiency, since ferritin is an acute phase protein which is elevated with liver inflammation and some malignancies. It also increases with age. It is therefore possible for the ferritin to be normal in anaemic patients who happen also to have inflammatory or malignant disease.)

Nail sex

In all three respects – constitution, weathering and repair – females' nails are worse off than males' nails. Female skin, including nails, is finer. Females often do more wet work, especially mothers, housewives and nurses. Nutritional insufficiency of women is very common, and, by definition, exclusive to females.

Brittle nails therefore have an overwhelming predilection for females.⁶

Treatment

The basis of good treatment is firm diagnosis. If wear and tear is excessive through overexposure to wet work or soap or a compulsive handwashing habit or excessive use of a bidet⁷ or obsessional manicuring, these factors need to be brought to the attention of the patient. If regeneration is impaired because of menorrhagia, food faddism or anorexia nervosa, each situation would require its own handling. The constitutional nature of

fine skin with fine hair and fine nails is less amenable to intervention and is best explained as being within the range of normal but at the finer end and therefore more susceptible to dryness and so more vulnerable to wear and tear. A better understanding of their susceptibility to brittle nails helps patients make simple modifications to their way of life, which help reduce weathering and so prolong the healthy life of their nails.

In the case of nutritional insufficiency of women, impaired nail growth is one feature of the disorder and iron deficiency another; but iron deficiency *per se* may not be the cause of the impaired nail growth. Rather, iron deficiency should be regarded as a proxy of the impaired nutritional state which causes the impaired nail growth. Therefore, simple replacement with iron is unlikely to be of as much benefit as a more broad replacement strategy. Moreover, iron supplements alone will correct the iron deficiency and will increase iron saturation (and ferritin) but may not fully correct nail regeneration. Therefore, it seems more physiological *not* to give iron supplements but instead to urge the patient to incorporate red meat or bacon into their daily diet and liver into their weekly diet. This strategy will improve the nails, iron saturation and also a broad range of other nutritional variables, about which too little is yet known.

All patients will benefit from reduction of exposure of nails to water, soap, wet work and tasks that use finger-nails. All will benefit from avoidance of overzealous manicuring and the use of only oil based nail varnish remover. All will benefit from application of emollients to the nail and the proximal nail fold. The thicker the emollients the

better, but there is of course a compromise here between efficacy and convenience, such that white soft paraffin may be acceptable by night but not by day, when only lighter moisturizers will be tolerated.

Conclusions

Brittle nails are an everyday modern phenomenon which results in much cosmetic and some functional disability.

References

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