



A new rapid diagnosis technique for dermatophyte nail infection

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Fungal nail infection (Figure 1) is a common clinical problem and is thought to affect between 2-8% of European adults (1). The condition is frequently a progression of chronic tinea pedis where skin infection from the sole of the foot and inter-digital area has gradually spread into the nail bed under the free edge of the nail proximally, and progressing under the nail. Dermatophytes are responsible for over 90% of all toenail infections - the most common species being *Trichophyton rubrum*, *Trichophyton interdigitale* and *Epidermophyton floccosum*.



Before treatment can commence it is important to establish a proper diagnosis – this is recommended in published guidelines in the management of fungal nail infections (2) because it offers

substantial evidence of fungal infection, reducing the risk of misdiagnosis. In private practice, if the diagnosis is not secured patients may be undergoing (and indeed paying for) a treatment that they don't need. Those in foot care see a lot of fungal nail disease and generally are probably feel quite adept at diagnosing the condition. However, it is important to remember that 40-50% or more of nail dystrophies are not caused by fungal nail infection (3) so a proper diagnosis is key as half of the nail problems seen in clinic may not be fungal in origin.

Many chiropodists/podiatrists will assume that they can easily detect a nail infection just by looking but how effective is that? In a published study using experts it was found that

visual diagnosis at best it is 67% successful (4). Although relatively high, it still means statistically that one in three diagnoses of fungal nail infection by a chiropodist/podiatrist will be incorrect.

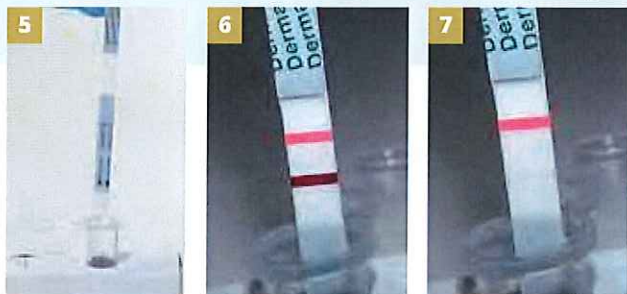
In order to secure a diagnosis a clipping needs to be taken from the affected nail and sent to the laboratory for two tests – microscopy and culture. Firstly, for microscopy. Samples are visually analysed under the microscope after application of potassium hydroxide and a stain of calcofluor white observed under UV light (5), to identify the presence (or absence) of fungal elements. The results of this can be obtained within a few days but this test only identifies the presence of a fungus.

The second part of the test is the culture where the nail sample is then placed on a dextrose agar plate and then cultured at 37° centigrade to encourage growth of any fungus present. If this is the case, then the species may be identified and reported back to the clinician. This can take 2-3 weeks. The result is considered positive for dermatophytes if either the culture or microscopy is positive although some argue that culture enables a more solid diagnosis as it confirms viable fungus exists in the nail and it can be readily identified (6).



The downside to culture, as many clinicians know, is the high false-negative rate – suggested to be around 30% or more which coupled with the time delay involved makes this test less attractive for regular clinical use. Culture failure can be due to a number of reasons. In one study of four podiatrists sampling technique, positive culture results ranged from 25-60% (7). The test also relies on sufficient amounts of nail sample to be made available to the laboratory for testing. Finally, the test itself can be costly to the practitioner to undertake.

A recent development in this field has meant that chiropodists and podiatrists can now undertake rapid testing for dermatophyte nail infection using a simple test in clinic without the need for a laboratory. The Dermatophyte Test Strip (INC Diafactory, Japan) is a quick method to establish if dermatophytes are present in a nail sample. Unlike traditional methods, the test does not use microscopy or culture to detect fungal infection but a technique called immunoassay.



A sample of diseased nail is taken from the patients nail and added to the disposable test tube (figure 2) and a few drops of solution is added to soften the nail and release any fungal elements into solution (figure 3). The sample is then stirred (figure 4). Next, a test strip is added to the test tube and is left in situ for five minutes (figure 5). After that time has elapsed, a pink line will be evident to indicate that the test has been activated. The presence of a purple-brown line beneath it indicates if a dermatophyte nail infection is present (figure 6) whilst no purple-brown lines signifies a negative result (figure 7).

The main question that logically follows is how accurate is the test? The Dermatophyte Test Strip has been tested in two clinical studies comparing it to traditional methods (microscopy and culture) and against more advanced laboratory testing (Polymerase Chain Reaction) (8,9). The results from this work have shown it to be 97.2% accurate when compared with these techniques suggesting it to be a useful clinical test for diagnosing dermatophyte nail infection. The test can detect eight species of dermatophytes (Trichophyton

mentagrophytes, T. rubrum, T. tonsurans, T. violaceum, T. verrucosum, Microsporum gypseum, Microsporum canis and Epidermophyton floccosum). Collectively these species are responsible for over 99% of all UK dermatophyte infections (10).

So how does it work? The test works by immuno-chemistry which is a common technique applied to other clinical tests such as pregnancy and drug testing kits. Within the test strip there are antibodies designed to specifically detect the presence of dermatophyte protein. If any is present, they will force the colour change in the paper indicating a positive result.

Ultimately, the test has the following advantages:

- 1 High levels of accuracy ensure a proper diagnosis is secured.
- 2 Undertaken in clinic and allows for a diagnosis in just five minutes.
- 3 Cost effective – each test is cheaper than standard laboratory testing.
- 4 The test has been shown to detect 8 different species of dermatophytes which collectively make up 99% of dermatophyte toenail infections.
- 5 Unlike culture and sensitivity, it can be used even if the patient has been applying antifungals to the nail.
- 6 The test can be purchased by the podiatrist and the patient charged directly so increasing business / practice turnover.
- 7 As a diagnosis is secured whilst the patient is in chair, a treatment plan can be formulated and commenced immediately with no wait for results.

The next stage, if positive, is obviously to inform the patient of the dermatophyte infection and discuss the various treatment options available such as oral or topical antifungal drugs, nail trephination using the Clearanail® device (11), nail surgery or laser treatment. It is always important to remember that adequate treatment of dermatophyte nail infection relies on a clear diagnosis, but also eradication of potential risk factors. This includes educating the patient about recognising and treating any re-occurring tinea pedis as this is often the main source of nail infection and recurrence following successful treatment. Various studies have highlighted how prophylactic treatment of tinea pedis can be successful at reducing recurrence of fungal nail infection (12,13).

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