Canine demodicosis and the role of demodex mites in rosacea

Researchers at University College Dublin are investigating the pathogenesis of canine demodicosis and the role of demodex mites in rosacea – a one health approach

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Demodex mites are normal cutaneous commensal parasites found in hair follicles and sebaceous glands of both humans and animals.[1,2] While they normally appear to live in harmony with their host, their over proliferation can result in serious skin disease. In dogs, an over proliferation of *Demodex canis* mites is known as canine demodicosis of which there are two main clinical forms, generalised and localised, both of which can have a juvenile (typically less than 18 months of age) or an adult onset of occurrence (typically over 4 years of age).[3] A third form of disease, pododemodicosis, is typically restricted to lesions present affecting the feet. Generalised demodicosis is often difficult to treat with rare fatal cases reported.[4] In humans, *Demodex brevis* or *Demodex folliculorum* mite over proliferation has been noted in skin diseases such as rosacea and pityriasis folliculorum, suggesting a potential role within the pathogenesis of these often socially disabling skin diseases.[2]

Figure 1: Demodex canis

Lesions of canine demodicosis consist of alopecic, erythematous, lichenified skin often with evidence of scaling and comedones. These lesions are most commonly noted on the face (periorbital and perioral) and the paws. Secondary bacterial infection and *Malassezia* dermatitis are common complications. While canine demodicosis may be suspected on clinical grounds, definitive diagnosis is by the finding of *Demodex* mites within deep skin scrapings, tape squeeze aspirates, trichograms or biopsies.[3] In humans, to assess the number of *Demodex* mites present within the skin, a standard skin surface biopsy is required.[5] This is a non-invasive method of extracting *Demodex* mites. In patients with rosacea, diagnosis is based on clinical symptoms of at least one diagnostic phenotype (fixed centrofacial erythema or phymatous changes) or at least two major phenotypes (papules and pustules, flushing, telangiectasia, and ocular manifestations); however, these patients display more than three times the number of *Demodex* mites than normal subjects.[6] The number of *Demodex* mites present within the skin is reportedly even higher in patients with pityriasis folliculorum as compared to rosacea.[7]

The pathogenesis of canine demodicosis and the role of *Demodex* mites in rosacea is poorly understood. While these mites are present in our normal subjects, there is limited knowledge of the host-mite relationship. In dogs, the main hypotheses include genetic defects such as defective T cell recognition, immunosuppressive pathways (cytokine modulation), excessive activation of the innate immune system and T cell exhaustion.[8-12] In humans, similarly, immunosuppression is thought to be involved as it is known to be associated with *Demodex* mite over proliferation.[13] It has also been shown that *Demodex folliculorum* can downregulate T cell expression and cause pro- and anti-inflammatory cytokine modulation.[14,15]

Figure 2: *Demodex folliculorum*

RESEARCH FOCUS

Our research is focussing on the role of the innate immune response in demodicosis. This is being done by investigating pro- and anti-inflammatory cytokine gene expression, Toll Like Receptor (TLR) expression and immune modulator expression within keratinocytes and sebocytes from biopsies of dogs with demodicosis. A similar *in vitro* investigation into pro- and anti-inflammatory cytokine gene expression, TLR and immune modulator expression using cell culture of canine keratinocytes and sebocytes following exposure to live *Demodex* mites compared to expression of these factors by the canine cell lines without exposure to *Demodex* mites, will also be carried out. These experiments mirror other research projects within our groups investigating the role of *Demodex* mites in rosacea.

This collaborative research project between human and veterinary medicine presents a unique chance to provide a new understanding of the pathogenesis behind these two important and related diseases, the findings of which may translate into changes in current therapeutic approaches.

References available on request.