Demodectic and Sarcoptic mange in dogs

Demodicosis

Demodex mites are normal inhabitants of a dog’s skin. Three different species are recognised, *Demodex canis* (most common, lives in hair follicles and sebaceous glands), *Demodex injai* (a long-bodied demodex mite, lives in hair follicles and sebaceous glands) and *Demodex cornei* (a short-bodied demodex, lives in the superficial epidermis)\(^1,4\).

Pathogenesis

Demodicosis is mostly seen in purebred dogs and in puppies and young dogs up to 18 months of age\(^6\). The mites are transmitted soon after birth from the mother to the pups. This is the only time that dog to dog transmission of the mites can take place\(^4\). Immunosuppression or a defective skin immune system will allow mites to proliferate and cause clinical demodicosis. This is common in puppies where endoparasites, poor nutrition and debilitation may result in a compromised immune system. Demodicosis may also occur in adult dogs and is a sign of immunosuppression (see later).

Classification

Demodex infections are classified as local or generalised and juvenile- or adult-onset. There is much debate as to exactly what the difference between a local and a generalised form is, therefore criteria which differentiate the different forms have not been uniformly established\(^6\).

A localised form involves 4 or fewer areas, often including the face and forelegs, with lesion diameter of < 2.5 cm\(^10\). Around 90% of these cases resolve spontaneously within 6 to 8 weeks. Dogs with generalised demodicosis usually have lesions in more than 4 areas of the body, with 2 or more feet affected or where an entire body region is involved\(^6,10\).

Juvenile-onset is typically found in dogs younger than 1 year of age and may present as localised or generalised disease. Adult-onset demodicosis is usually seen in dogs older than 4 years of age. Every attempt should be made to identify an underlying cause or concurrent illness in these cases. Where an underlying cause cannot be identified at the time of diagnosis, monitoring should continue during the treatment period. Underlying causes include diabetes mellitus, hyperadrenocorticism (spontaneous or iatrogenic), hypothyroidism, neoplasia, chemotherapy, other immunosuppressive drugs and endoparasitism. Interestingly
many immunosuppressed dogs never develop demodicosis and in half of the cases an underlying cause is never found. 

Clinical signs

Mildly affected cases often have mild erythema, focal alopecia and scaling (Figure 1). In more severe cases alopecic foci coalesce and follicular papules and casts are present. Follicular pustules and furunculosis with crusts and exudation are seen with advanced cases. Chronic cases become hyperpigmented and lichenified and have an increased body odour due to excess sebum production from the sebaceous glands. Lesions are initially often seen on the face and forelegs (Figures 2 and 3) and then progress to other body sites. Dogs with generalised demodicosis may show lymphadenopathy, fever and lethargy. Most cases have secondary bacterial pyoderma. Pedal demodicosis (Figure 4) is often extremely painful due to interdigital oedema.

Diagnosis

Multiple, deep skin scrapings with a #10 scalpel blade of affected areas in the direction of hair growth, is the diagnostic test of choice (Figure 5). Mineral oil applied to the areas to be scraped, ensures that scraped materials stick to the blade. Scraping should be deep enough to cause capillary bleeding and squeezing of the scraped area, forces mites from the hair follicles to the surface. Fusiform eggs, six-legged larvae, eight-legged nymphs or eight-legged adults (dead or alive) can be seen microscopically (Figure 6). The number of mites per scrape (dead and alive) of each life stage should be recorded at each visit to help monitor response to treatment.

Trichography (Hair plucks) is used to find adult mites on hair shafts in areas difficult to scrape, e.g. periorbital and interdigital areas. Hairs are plucked with a forceps in the direction of hair growth and placed in a drop of mineral oil on a slide. Trichography is not as reliable as skin scrapings and should complement and not replace skin scrapings.

Skin biopsies for histopathological examination may be necessary when skin scrapings are negative for mites but the clinical suspicion is high. This is often necessary in patients with a thick skin, e.g. Shar Pei dogs and in chronic pedal demodicosis.

Cytology of exudates can reveal mites in cases where mites are abundant. Secondary bacterial pyoderma is diagnosed where bacteria are found inside neutrophils.

Treatment
The general health of patients with generalised demodicosis should be evaluated prior to commencing treatment. Treatment of demodex cases can be a therapeutic challenge because treatment duration is long (weeks to months), requires time and financial commitments from the owner and requires frequently check-up examinations. Client compliance is very important for successful treatment.

The following acaricidal drugs and adjunctive treatments may be used:

1. **Amitraz:**

   This is an approved treatment for canine demodicosis. It is a topical medication usually applied as a rinse. The recommended concentration varies between 0.025 to 0.06% and is recommended every 7 to 14 days. Clinical efficacy increases with increasing concentration and shorter treatment intervals. A benzoyl peroxide shampoo prior to the amitraz rinse is beneficial due to its follicular flushing and a keratolytic effect. Clipping the hair coat of medium to long haired dogs is recommended. Amitraz should be diluted with warm water before each rinse as it is rapidly oxidised and altered by ultra-violet light. Rinses should be applied with a sponge, the skin soaked and protective clothing and gloves should be worn. Patients should be allowed to dry naturally and should not be towelled off. Amitraz may cause headaches and asthma in owners, therefore dogs should be rinsed in well ventilated areas. Studies have shown that amitraz rinses are less effective in adult-onset demodicosis as only one third of dogs responded to amitraz therapy compared to two-thirds of juvenile-onset dogs. Higher concentrations at shorter intervals may be required in these cases. Daily topical footbaths with amitraz are indicated for dogs with pedal demodicosis.

   Adverse effects include depression, sedation, ataxia, bradycardia, polyuria, polydipsia, hypothermia and hyperglycemia. Patients with diabetes mellitus are therefore not good candidates for this therapy. Certain toy breeds e.g. Chihuahuas are more likely to experience side effects from this drug. Yohimbine, a α2-adrenergic antagonist (0.1 mg/kg IM) is the antidote when side effects are severe.

2. **Ivermectin and related compounds:**

   These drugs are macrocyclic lactones and can be subdivided into 2 groups, the avermectins (Ivermectin, Doramectin) and the milbemycins (Moxidectin and Milbamycin). All members of this group can potentially cause fatal central nervous system depression. This is due to failure of the p-glycoprotein pump to remove these drugs from the central nervous system. This may be caused by a) a genetic defect associated with the MDR-Δ1 (ABCB 1-D1) gene which is very common in collies, shelties and other herding breeds, but may be seen in all breeds, b) non-MDR associated pump defects or c) drug competition for p-
glycoprotein. Many drugs compete for this pump e.g. ketoconazole, itraconazole and cyclosporine. If any of these are given together with members of the macrocyclic lactones, fatal side effects can occur.

2.1 **Ivermectin**: This is the first choice treatment of many dermatologists, although it is not licensed for use in canine demodicosis. It is easy to administer and cost effective. The oral route of administration is the most effective. A number of studies that evaluated daily oral administration of ivermectin showed good treatment success. This is in contrast to studies evaluating weekly injections of ivermectin, which gave variable and inconsistent results. The 2011 clinical practice guidelines for the treatment of demodicosis in dogs recommend oral ivermectin at a dose of 0.3-0.6 mg/kg daily for therapy of generalised demodicosis. 0.3 mg/kg daily is usually effective. Two-thirds of dogs with adult-onset demodicosis respond to ivermectin therapy.

Due to the severe side effects in especially the herding breeds (as mentioned above), it has been recommended to gradually increase the daily ivermectin dose over 5 days to the recommended dosage to identify any adverse effects. A starting dose of 0.05 mg/kg on day 1, 0.1 mg/kg on day 2, 0.15 mg/kg on day 3, 0.2 mg/kg on day 4 and 0.3 mg/kg on day 5 in all breeds treated, is recommended. Midriasis and ataxia are clinical signs indicating ivermectin-sensitivity.

2.2 **Doramectin**: This drug has been reported as a successful treatment for canine demodicosis, but is also not licensed for use in dogs. The recommend dosage is 0.6 mg/kg subcutaneously once a week or 0.3 mg/kg orally twice a week. This drug is not safer than ivermectin, therefore the dose should also be gradually increased to therapeutic dose. This is used for dogs where owners cannot give oral medication and weekly injections are more convenient.

2.3 **Moxidectin**: This drug has shown comparable efficacy to ivermectin when used at 0.2-0.5 mg/kg/day orally. It is not licensed for use in dogs, but may be effective in ivermectin-resistant cases because it is not an avermectin. As with ivermectin and doramectin, it is recommended to start at a lower dose and gradually increase to the recommended dose.

2.4 **Milbemycin oxime**: This is a licensed drug for the treatment of demodicosis and an alternative choice for ivermectin- and doramectin-sensitive breeds. The recommended dosage is 1 – 2 mg/kg/day orally. A recent study has shown that ivermectin-sensitive breeds can have adverse neurological effects, but these were less severe than with ivermectin and doramectin.

3. **Systemic antibiotics**:

Secondary bacterial pyoderma often complicates demodicosis. Antibiotics effective against *Staphylococcus pseudintermedius*, the most common pathogen in canine pyodermas, such as cephalosporins (cephalexin), and amoxicillin-clavulanic acid,
should be used. Treatment duration should be for a minimum of 3 weeks. Deep pyoderma require longer treatment until complete resolution.

4. **Topical treatment:**

Antibacterial shampoos e.g. benzoyl peroxide and chlorhexidene are beneficial when treating demodicosis. Shampooing with benzoyl peroxide prior to an amitraz rinse often makes the rinse more effective due to its follicular flushing effects assisting the amitraz reaching the mites. Chlorhexidene shampoo is used in between the rinses⁶. In addition to the antimicrobial effects, shampooing also removes crusts and debris that contain mites, exudates and inflammatory mediators¹⁰.

5. **Other treatments:**

Good quality nutrition and reduced stress can help successful treatment of demodicosis. Fatty acid supplementation has been shown to have a possible beneficial effect¹³. Effective control of endoparasites and treatment of concurrent diseases is also of the utmost importance. There is insufficient evidence to recommend treatment of canine demodicosis with amitraz collars, closantel, vitamin E, herbal and homeopathic preparations¹⁰.

**Monitoring response to treatment:**

Patients should be re evaluated every 3 to 4 weeks until 2 consecutive negative skin scrapings. At the first check up there should already be very few or no immature mites and the percentage of dead adult mites should be higher than the percentage of live adult mites. This is an indication of owner compliance and effective therapy⁶. Treatment may take up to 6 to 12 months before 2 consecutive negative skin scrapings are obtained. Rechecks and scrapings should be performed every 3 to 4 months for the first year after cure.

**Prognosis**

Juvenile-onset generalised demodicosis has a reported successful cure rate of 70 to 80%⁶. Dogs with adult-onset demodicosis have a much lower rate of cure especially where the underlying disease cannot be cured or controlled¹⁰. Pedal demodicosis also is very difficult to cure and has a poor prognosis.

**Prevention**

A genetic basis has been suggested in juvenile-onset demodicosis due to definite breed predispositions, high frequency of disease in puppies from affected parents
and successful decrease of the prevalence in kennels where affected dogs were excluded from breeding. It is therefore recommended not to breed from any dog with generalised demodicosis and to neuter affected animals. This is very important in female dogs where the oestrus cycle, pregnancy and lactation may trigger recurrence of clinical disease.

**Sarcoptes**

Sarcoptic mange is caused by *Sarcoptes scabiei var canis*. These mites are not normal inhabitants of a dog’s skin and are able to infest a wide range of mammals.

**Pathogenesis**

Sarcoptes mites are contagious and are transmitted by direct contact. Dogs of any age or breed can be affected, but puppies are more susceptible because of contact with siblings. The prevalence depends on the local population of affected animals that serve as carriers. Mites are more common in dogs living in groups, dogs that roam and dogs visiting grooming facilities. Mites can also be acquired from contaminated environments e.g. kennels, crates or dog baskets. Human involvement can be seen in 25 to 30% of cases. Mites cannot breed in human skin and only live 2 to 3 weeks on human skin. Affected humans may have papules and pruritic crusts on the forearms, trunk and legs. Mite salivary antigens can cause type I, III and IV type hypersensitivity reactions.

**Clinical signs**

The incubation period is 3 weeks after contact with a contaminated host or environment.

Intense pruritus is the most common clinical sign.Scratching is usually focused on the ventrum, ear pinnae, elbows and hocks. All body surfaces may be affected (Figure 7), but generally not the dorsum. A positive pinnal-pedal scratch reflex (scratching the edge on the pinna results in the ipsilateral leg making scratching movements) is present in 75 to 90% of cases. This test has a high specificity of 93.8% and a relatively high sensitivity of 81.8%. Initial skin lesions are erythematous papules and papular crusts that are especially seen on the elbows, hocks and ear pinnae (Figure 8). Generalised lymphadenopathy is often present. In chronic cases hyperpigmentation, hyperkeratosis and lichenification of affected areas is typically seen.

**Diagnosis:**
Multiple skin scrapings, especially of papular crusts on the ear pinnae, elbows and hocks may reveal eggs, mites or mite faeces. A single mite (Figure 9) or egg is diagnostic. A negative scraping does not rule out scabies. Mites live in the stratum corneum, therefore too deep scrapings will miss them.  

Faecal flotation: Eggs or mites may be seen in faecal flotations as affected dogs often bite lesions and may swallow the mites or eggs.  

Histopathology is usually not diagnostic as it rarely yields mites or eggs. Findings are not specific and are similar to those of any pruritic skin condition.  

Therapeutic trial: Response to treatment is usually dramatic and therefore is indicated in a highly suspicious case where no mites can be found on scraping. Mites are only found in 20 - 50% of cases.  

Treatment:  

Treatment is always indicated as spontaneous recovery seldomly occurs. Treatment consists of topical and/or systemic acaricidal treatment and supportive treatment.  

1. Topical acaricidal treatment  

Amitraz rinses (0.025 - 0.05%), every 7 to 14 days, 3 times. Medium to longhaired coats should be clipped for more effective treatment. Do not use in Chihuahuas, pregnant or nursing bitches and puppies younger than 3 months of age.  

Fipronyl spray (0.25%): at 3 ml/kg, three times at three week intervals for puppies older than 8 weeks and 6 ml/kg once weekly for 2 weeks for adults has been shown to be effective.  

Selamectin at 6 mg/kg, two spot on applications a month apart have been shown to be effective. Do not use in dogs younger than 6 weeks.  

2. Systemic acaricidal treatment  

Most of these drugs are not licensed for use in dogs, therefore all precautions when using these drugs should be followed as discussed in the demodex section.  

Ivermectin: 0.2 – 0.4 mg/kg subcutaneously every 2 weeks for 2 to 3 treatments or 0.2 – 0.4 mg/kg orally once a week, 3 times.  

Doramectin: 0.2 mg/kg subcutaneously every 2 weeks, 2 to 3 times.
**Moxidectin**: 0.2 – 0.25 mg/kg orally or by injection weekly for 3 to 6 weeks\(^{18}\).

**Milbemycin**: 2 mg/kg every 7 to 14 days, 2 to 3 times\(^{18}\). Some authors regard it not as effective as ivermectin\(^1\).

3. **Supportive treatment:**

**Prednisolone** at 0.5 - 1 mg/kg tapering for a few days. Typically pruritus is increased during the first 2 to 3 days after commencing treatment in a dog with scabies.

**Antibiotics** effective against *Staphylococcus pseudintermedius* where secondary bacterial pyoderma is present, for a minimum of 3 weeks.

**Shampoos**: Weekly keratolytic shampoos aid in removing scales, debris and crusts. This is alternated with antibacterial shampoos, e.g. chlorhexidene, to treat the secondary bacterial pyoderma.

**All in contact animals** also need to be treated, whether they show signs of pruritus or not\(^1\).

**Environmental treatment** is usually not necessary, unless multiple pets in a household are affected. Contaminated kennels, crates or brushes should be burnt or steam cleaned\(^4\).

**References:**


7. Hugnet C, Bruchon-Hugnet C, Royer H 2001 Efficacy of 1.25% amitraz solution in the treatment of generalized demodicosis (eight cases) and sarcoptic mange (five cases) in dogs. Veterinary Dermatology 12: 89-92


