Combined decongestive therapy including equine manual lymph drainage to assist management of chronic progressive lymphoedema in draft horses

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Summary

Equine chronic progressive lymphoedema (CPL) is a disabling disorder of draft horse breeds. Combined decongestive therapy (CDT) is the treatment of choice for lymphoedema in people and has been adapted for use in horses. Equine CDT - which includes manual lymph drainage (MLD) and subsequent bandaging with short stretch bandages - was expected to improve the symptoms of CPL in draft horses, because CPL resembles primary lymphoedema in humans. Five affected horses - Gypsy Cob (1), Clydesdale (1), Shires (3) - were included. Lesions were documented pre- and post treatment. Percentage volume loss of the distal legs was calculated using the disc model. Initial plans for daily CDT had to be adapted; intermittent treatment of Chorioptes infections required alternating between CDT and MLD in 4/5 horses. Concurrent pyoderma (1/5 horses) was treated throughout the study. Development of unrelated lameness (hoof abscess) allowed limited CDT treatment only in one horse. Marked softening of previously firm tissue indicated the change from ‘brawny’ to pitting edema in 2/5 horses. Fibrotic nodules and folds in the pasterns became markedly softened and smaller in 2/5 horses. Skin surface notably improved in all horses: hyperkeratosis decreased, erosions and ulcerations healed completely and crusts disappeared. After two weeks a mean volume reduction of 11.25% was seen, ranging from 4.75% to 21.74% and quality of movement improved. This pilot study documents evidence that CDT assists management of CPL. Current CPL management is limited to palliative treatments of secondary infections. While not a permanent treatment, CDT offers a promising tool to manage horses with CPL, improving their quality of life and potential usefulness. More extensive and prolonged studies with a larger number of horses are warranted to evaluate the full potential of CDT.

Introduction

Equine chronic progressive lymphoedema (CPL) has been identified in several draft horse breeds with heavy feathering, including Shires, Clydesdales and Belgian Draft horses (De Cock et al. 2003). Recently it has also been recognized in Gypsy Cobs (personal observations). Typically, lymphoedema first appears as a soft, pitting subcutaneous edema, which is often not identified in the presence of heavy feather. However, careful palpation allows detection of small fibrotic folds and edema in horses as young as 2 years of age (De Cock et al. 2003; Ferraro 2003), sometimes mistaken for scar tissue due to mite infestation. Slowly progressive swelling of the distal extremities ultimately results in marked fibrosis and induration, firm large tissue folds and nodules (De Cock et al. 2003; Ferraro 2003). This reflects lesions seen with lymphoedema in people (Sisto and Khachemoune 2008). Development of fibrosis is not only disfiguring (De Cock et al. 2003; Ferraro 2003), it damages other tissues, affecting nerves, blood and lymphatic vessels, slowing delivery of oxygen to tissues and removal of metabolic waste products. Large fibrotic nodules and folds on the lower extremities are vulnerable to damage and can impair free movement of the joints leading to lameness.

As a result of lymphoedema and poor tissue perfusion the integrity of the skin’s barrier function is impaired. Decreased immunoserveillance is setting the stage for recurrent parasitic and bacterial infections, which reflects the situation in humans with chronic lymphoedema (Devillers et al. 2007; Bernard 2008; Damstra et al. 2008; Ryan 2009). Recurrent infections can be addressed therapeutically, but folds and nodules do not regress with antibiotic and antiparasitic treatments and affected horses are often misdiagnosed with “therapy-resistant” pastern dermatitis (Wallraf et al. 2004; Geburek et al. 2005a and 2005b). This debilitating condition can lead to loss of use and premature death by euthanasia.

For decades combined decongestive therapy (CDT) has been the preferred treatment for lymphoedema in people, as documented by the International Society of Lymphology, (Lymphology 2009). It reduces edema and promotes regaining and maintaining of normal or near normal limb size by preventing...
reaccumulation of fluid, breaking down fibrosis and preventing infection (Földi et al. 2006). As a result patients experience relief of pain and discomfort. Movements are restored by weight reduction and enablement of joints, tendons, ligaments and muscles to function more effectively. If applied correctly CDT is safe, effective, inexpensive and has very few contraindications.

Combined decongestive therapy is performed in two integrated phases (Lymphology 2009). The initial intensive phase involves daily manual lymph drainage (MLD), skin care, multi layer compression bandaging and exercise. The second maintenance and optimisation phase starts immediately after the intensive phase and involves the use of specialized compression garments, continued skin care and exercise.

Combined decongestive therapy has been validated for use in horses with secondary lymphoedema following lymphangitis (Rötting 1999; Fedele and von Rautenfeld 2005 and 2007). This pilot study documents positive effects of CDT in 5 horses affected with CPL.

**Material and Methods**

**Horses**

Five privately owned horses (one Gypsy Cob, one Clydesdale, three Shires) were stabled in box stalls with free access to separate attached dry paddocks at the Center for Equine Health, University California Davis. Detailed information about each horse is listed in Table 1. Due to time and financial constraints, treatment was limited to two legs per horse. Legs were clipped prior to taking pre-treatment measurements. Numerous cutaneous fibrotic nodules gave the clipping an irregular appearance (horses #3, 4 and 5).

<table>
<thead>
<tr>
<th>Horse</th>
<th>Breed</th>
<th>Sex</th>
<th>Age (years)</th>
<th>Additional comments</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Gypsy cob</td>
<td>Mare</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Clydesdale</td>
<td>Mare</td>
<td>10</td>
<td>Club feet: right front deformed&gt;left front; bilateral hind feet. Poor maintenance of feet</td>
</tr>
<tr>
<td>3</td>
<td>Shire</td>
<td>Mare</td>
<td>17</td>
<td>Marked firm swelling ventral abdomen cranial to mammary gland, right side&gt;left side</td>
</tr>
<tr>
<td>4</td>
<td>Shire</td>
<td>Mare</td>
<td>16</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>Shire</td>
<td>Mare</td>
<td>5</td>
<td>9 months pregnant</td>
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</table>

**Measurements**

Measurements were taken at the start and end of the study. Initial volume and subsequent reduction were assessed with the disc model, which has been proven to give satisfactory results and is suitable for use with horses (Haase et al. 2009). The disc model uses sequential circumferential measurements to calculate cylindrical volume (Sander et al. 2002; Fedele and von Rautenfeld 2005 and 2007; Tewari et al. 2008). Circumference measurements, starting from a set point from ground level and repeated every 4 cm, were taken between the fetlock and tarsal or carpal joint respectively. Due to large folds and nodules, pastern measurements were inconsistent and hence, excluded. The volume (V) was calculated using the sequential circumference measurements (C):

\[ V = (C_1^2 + C_2^2 + C_n^2) \times n^{-1}. \]

In cases where no “normal” unaffected legs are available for comparison – as was the case in this study - the following formula has been established for calculations of percentage loss, where \( V_F \) = final volume and \( V_I \) = initial volume (Kuhnke 1978):

\[ \text{Reduction} \% = \frac{(V_F - V_I)}{V_I} \times V_I^{-1} \times 100 \]

**Lesion documentation**

The lesions were photographically documented before initial treatments and after study completion. Skin scrapings documenting Chorioptes infestations were regularly performed.

**Combined decongestive therapy**
CDT – Phase I: treatments are repeated daily until changes in volume reduction measurements cease (Földi et al. 2006). Daily MLD and skin care are followed by specialised multi-layer compression bandaging and exercise. Manual lymph drainage - a manual therapy resembling massage - moves lymph ‘transterritorially’ from affected areas to ones where the system is functioning adequately and is always applied proximally, at the jugulo-subclavian area, before treating the affected region (Földi et al. 2006). MLD supports and stimulates the lymphatic system to remove accumulated proteins and water from the interstitium back to the blood stream (Wittlinger and Wittlinger 1998). Specific ‘fibrosis’ techniques are used to break down and disperse fibrotic and indurated tissue (Földi et al. 2006).

Equine MLD techniques have been adjusted to accommodate anatomical differences between people and horses (Fedele and von Rautenfeld 2005 and 2007). Due to the anatomy of the equine distal limb, MLD also directly influences the regional deep lymphatic system.

Following MLD the skin is moisturized as required and multi layer compression bandaging is applied in a distal to proximal direction using short stretch bandages, which overlay foam pads in humans (Földi et al. 2006) and thick cotton wool padding in horses (Fedele and von Rautenfeld 2005 and 2007) to distribute the pressure evenly. Short stretch bandages have a low working pressure when muscles are relaxed and a higher working pressure during exercise. This provides supportive pressure to the lymphatic vessels and prevents reaccumulation of lymph fluid. Exercise is then undertaken after bandaging to increase the flow of lymph.

Phase II: Skin care and exercise are continued. In human practice bandages are commonly replaced by specialised knitted cotton compression garments with distal to proximal graduated pressure, worn daily, for 12-24 hours. MLD treatments are tapered off to a minimum of every six months or according to individual needs at which time garments are refitted. In severe cases, CDT treatment may be repeated (Földi et al. 2006). Elastic compression stockings, which support the flow of lymph, are available for horses.

Treatment program

Daily treatments for 14 days were planned, based on a previous documentation (Rötting 1999). The owners were advised to treat each horse for existing infections (mite infections or bacterial infections) prior to this study. Each horse received MLD performed by an Equine MLD practitioner (Heather Powell: http://www.equinemld.com; certified by the “Europäisches Seminar für Equine Lymphdrainage” through the Medizinische Hochschule Hanover; http://www.ml-pferd.de). As described above, MLD was followed by multi-layer compression bandaging of both treated legs, using cotton wool padding and short stretch bandages (ROSIDAL K®). Each horse was then hand-walked for 20-30 minutes.

Skin scrapings for chorioptic mange were repeated and if positive, anti-parasitic treatment with fipronil (Frontline®) was initiated. Superficial bacterial infections were treated with topical Cephapirin sodium (Cefa-Lak®). Grooming tools were cleaned and washed in 10% hydrogen peroxide and rinsed after each use.

Follow-up maintenance

Due to constraints described previously, the inclusion of Phase II CDT was not planned for this study, however to support the reduction of edema, equine compression stockings were given to owners of the horses that responded to Phase I.

Results

Lesions before treatment

The severity of skin lesions - listed in Table 2 - varied from relatively mild to severe. Mild lesions were characterised by non-pitting oedema and small firm fibrotic folds in the palmar or plantar pastern. Distal limbs lacked visual and palpatory definition of normal anatomic structures such as bony protuberances, joints and tendons, but rather had a “cone”-like appearance (Fig 1). Severely affected legs had marked fibrotic folds and nodules measuring up to 4.5 cm in diameter resulting in marked disfigurement of the distal limb (Fig 2).
Fibrous folds and nodules were most prominent in the pastern and to a lesser degree on the palmar and plantar aspects of the cannon (Fig 3). Palpation of underlying structures was difficult and movement was restricted in the two most affected horses (horses #3 and #4). Multiple erosions, small hemorrhages, ulcerations and miliary crusts became evident upon clipping (Fig 4). Horse #2 presented with deep, firm, folds in the plantar pastern, which completely obliterated the natural profile (Fig 5). The skin surface of the folds was eroded, severely erythematous, oozing and malodorous, indicating superficial intertriginous dermatitis. As infection was limited to the skin surface, CDT was initiated simultaneously to topical treatment of the bacterial infection. Cranial to the mammary gland, horse #3 had a marked linear, firm, non-painful swelling on the ventral abdomen. The swelling was not warm. The udder was normal.

Adjustments to treatment plan
Upon owner’s request the front legs were treated in horse #3, as severe fibrotic nodules limited the horse’s movement in the front. Both hind legs were chosen for treatment of remaining horses. Frequency of CDT and MLD and individual responses of each horse to treatment are listed in Table 2.
Horse #2 responded well to topical Cephapirin sodium and tolerated concurrent CDT well. The skin surface dried out and erosions cleared after 5 days. One week into the study CDT had to be discontinued when this horse developed an abscess in her right front hoof. Because of marked discomfort, bandaging and walking was stopped and appropriate treatment for the hoof abscess was initiated. Treatment of the superficial skin infection and MLD were continued for the remainder of the study.

The warmth provided by the bandages may have encouraged a flare-up of latent mite infections in horses # 3, 4 and 5. The horses were pruritic, stomping and scratching their legs and mites were detected on skin scrapings. Horse #3 and 4 received fipronil treatments every other day during the first week of the study and MLD was continued daily previous to the fipronil application. On days of fipronil treatment legs were not bandaged to avoid occlusion and additional irritation. Combined decongestive therapy was re-initiated the following day. The pregnant mare (horse # 5) was not treated with fipronil, but brushed carefully, treated with MLD daily and simply not bandaged on some days.

Suitable cotton wool padding for compression bandaging could only be used once and the study had to be terminated 2 days early due to unforeseen problems with padding supplies.

**Clinical observations throughout treatment**

Individual responses to treatment are listed in Table 2. Typically edema reduction was observed after the first CDT treatment. By the third CDT treatment, previously obscured underlying structures – such as tendons - were more distinct to palpation. This was particularly evident in horse #3. Indurated, fibrotic nodules and deep folds in the distal leg became more defined as the marked edema between nodules and folds reduced. The tissue between the nodules and folds was less firm to touch indicating the change of a ‘brawny’ edema into a pitting edema, in particular in horses #1 and #5. Horse #1 regained a normal pastern shape, which was immediately observed by her owner at the end of the study. With continued treatment many nodules and folds decreased in size and were softer to palpation, in particular in horses #3 and 4 (Fig 6), indicating decrease in tissue fibrosis. Overall, the quality of the skin surface improved dramatically in all horses; hyperkeratosis decreased, erosions and ulcerations healed completely, and crusts were no longer present (Fig 7). With reduction of edema, infected skin folds in the pasterns of horse #2 softened and reduced in size enabling better access for topical treatment. The improved skin condition, reduction of skin folds (Fig 8) as well as edema reduction in the distal limb was noted before CDT had to be stopped prematurely.

All horses were compliant to treatment and four horses (#1, 3, 4 and 5) had excellent responses. The obvious edema reduction as well as softening of the nodules and folds resulted in a better range of limb movement, most obvious in horses # 3 and 4. The improved movement was immediately observed and spontaneously commented upon by their owners at the end of the study. The ventral abdominal swelling in horse #3 reduced in size and firmness and was interpreted as a systemic effect of MLD.

**Measurements**

Initial and post-treatment measurements and volume reductions are listed in Table 2. There was an edema volume reduction between 4.75% and 21.74%, with a mean of 11.25%. The lowest and highest reduction was observed in horse #3 and #1 respectively.

<table>
<thead>
<tr>
<th>Horse</th>
<th>Clinical observations pretreatment</th>
<th>CDT</th>
<th>MLD</th>
<th>D%L</th>
<th>D%R</th>
<th>Clinical observations post treatment</th>
</tr>
</thead>
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| 1     | Hind legs: Firm fibrotic plantar folds in pastern; multifocal erosions and crusts plantar cannon. Very sensitive to touch. | 4   | 10  | 13.23 | 21.74 | • Extremely sensitive about having lower hind legs touched  
• Mild sedation to perform CDT and MLD  
• Skin surface improved  
• Skin and subcutaneous tissue softer  
• Shape of fetlock and pastern better defined |
| 2     | Hind legs: pliable nonpitting oedema. Distal 3rd of cannon bone, fetlock and pastern enlarged, firm no definition. Deep infected folds | 4   | 7   | NA  | NA  | • Quick response to CDT  
• Subsequent good response to topical therapy  
• CDT suspended after 5 treatments due to development of lameness on front leg, suggestive of hoof abscess. |
in plantar pastern, smaller fold above ergot, fetlock.

3 Front legs: Many extremely firm cutaneous nodules completely covering legs distal to carpus. Difficult to palpate underlying structures. Large nodules (4.5 cm in diameter) in pastern areas, horizontal linear firm folds across dorsal pastern.

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<td>8</td>
<td>9</td>
<td>11.26</td>
<td>4.75</td>
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- Treatment of hoof abscess and MLD only
- Returned home early
- CPL at a relatively early stage. Fair response considering limited CDT treatment
- Oedema between nodules reduced
- Improved palpation of underlying structures
- Firm nodules softened, palmar pastern nodules smaller
- Tissues more pliable
- Skin surface over nodules less hyperkeratotic
- Freedom of movement visibly improved

4 Hind legs: Many extremely firm nodules on distal legs. Erosions, ulcerations and fibrous folds on plantar aspect of cannon bones. Horizontal firm folds across pastern and slightly overlapping hoof wall.

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<tr>
<td>8</td>
<td>9</td>
<td>14.69</td>
<td>12.16</td>
</tr>
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- Oedema reduced
- Improved definition of leg shape and palpation of underlying structures
- Softening of firm nodules
- Erosion and ulcerations fully re-epithelised
- Freedom of movement visibly improved

5 Hind legs: firm folds and nodules in pastern, firm swelling to approx. 8 cm proximal to fetlock. Above swelling softer.

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<tr>
<td>8</td>
<td>9</td>
<td>6.14</td>
<td>6.05</td>
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- Oedema reduction at plantar aspect of distal legs
- Tissue softening to ‘pitting’ oedema
- Reduction in fetlock area
- Fibrotic folds in plantar pastern region softened and reduced
- Improved skin surface, healed erosions
- Freedom of movement visibly improved

CDT: combined decongestive therapy; MLD: manual lymph drainage; D%L: percent volume reduction in the left leg; D%R: percent volume reduction in the right leg; NA: not applicable.

Maintenance and follow-up

Although phase II CDT was not included in this study, compression stockings were given to owners of horses #1,3,4 and 5 who were instructed in their use and advised to keep them on the horses for at least 12 hours daily. Some of the stockings were adapted by adding sturdy zippers and elastic inserts to accommodate the size of the legs of these draft horses. The owners of horses #3 and 4 reported that after their return home, both horses were trotting and galloping more freely during their turn-out time.

Follow-up after six months revealed that due to various reasons none of the owners issued with compression stockings had been able to use them continually. Owners reported that reduction in edema and fibrotic nodules and improvement in movement appeared to have been largely maintained, indicating that changes produced during intensive treatment were not transient.

Discussion

This pilot study documents evidence that combined decongestive therapy (CDT) offers a helpful tool in assisting the clinical management of chronic progressive lymphoedema (CPL), which mostly affects heavy draft horses with pronounced feathering – including Belgian draft horses, Shires and Clydesdales (De Cock et al. 2003; Ferraro 2003).

Etiology of equine CPL has not been identified, which reflects the situation with primary lymphoedema in humans (Devillers et al. 2007; Ryan 2009). The exact incidence of CPL within a breed has not been determined. However, within affected breeds, it is difficult to identify completely unaffected horses amongst animals older than 10 years of age (De Cock et al. 2003; Ferraro 2003), suggesting a genetic background to this disorder. Elastin is crucial for effective function of lymphatic vessels and appropriate lymph drainage (Ryan 1989; Skobe and Detmar 2000). Altered elastin metabolism and elastin degradation are crucial contributors to equine CPL (De Cock et al. 2006a, 2006b and 2009; van Brantegem et al. 2007a and 2007b). Similar to elephantiasis verrucosa nostra in humans (Devillers et al. 2007; Ryan 2009), skin barrier function in CPL is impaired. This sets the stage for recurrent bacterial and parasitic infections in affected horses, also referred to as therapy resistant pastern dermatitis (Geburek et al. 2005a and 2007b; Kugler 2008).
Currently, options for CPL management are limited to palliative treatments of the secondary infections and maintenance of a clean skin surface. As shown in humans with lymphoedema (Sisto and Khachemoune 2008; Lymphology 2009), avoidance of trauma and superficial skin infections is crucial in managing CPL. The moist, densely hyperkeratotic skin surface covered by heavy feathering sets the perfect stage for reinfection with chorioptic mites and bacterial infections (Rüfenacht et al. 2010; Risberg et al. 2005). Careful grooming and drying of distal legs, avoiding friction, routine skin scrapings and early treatment of chorioptic mange are crucial, which often requires clipping of the feather. Surgical debulking of fibrotic nodules followed by bandaging, as documented in a Belgian draft horse (Vlamink et al. 2008), can further damage the lymphatic system in the tissue and hence, is only performed for people who do not respond to CDT (Warren et al. 2007).

Combined decongestive therapy is the state of the art treatment for acute and chronic lymphoedema in humans (Cheville et al. 2003; Tiwari et al. 2003; Koul et al. 2007). For best results, CDT should be initiated as early as possible with the aim of regressing the lymphoedema to a stage of latency, free of signs and symptoms. With marked fibrosis the condition requires extended treatment and results may not be as satisfactory, but CDT still produces observable improvement (Földi et al. 2006).

Although horses have a high susceptibility to lymphoedema in their lower extremities - usually referred to as “filled legs” and “stocking-up” - the equine lymphatic system has not been subject to extensive studies. Recent reports by the University of Hanover have documented the effectiveness of CDT for equine lymphangitis induced lymphoedema (Rötting 1999). Horses are also more responsive to MLD than people (Fedele and von Rautenfeld (2007); von Rautenfeld and Schacht 2006). However, to the authors’ knowledge, there are no reports documenting the effects of CDT and MLD in horses affected by CPL.

Despite several challenges encountered during this pilot study, all horses showed improvement of their skin condition as well as reduction of edema and volume of their lower legs. As a result the distal limbs regained better definition of their normal structures. The horses’ movement improved due to softening of fibrotic nodules and folds. Based on reports in humans (Lindemayr et al. 1980; Földi et al. 2006), these are considered positive effects of successful CDT. The intention to treat horses with CDT daily for 14 days was impeded by a number of factors, including reduced number of times horses could be bandaged due to flare-up of mite infections, insufficient supplies of suitable padding material and limited time and personnel available for post-treatment exercise. The pastern intertriginous pyoderma and in particular the development of a hoof abscess further limited the results in horse #2. Hence, treatments could not be pursued until maximum volume reduction had been reached.

The marked percentage volume reduction, as seen in these horses, is an important feature of assessing successful CDT treatment in humans as well as in horses (Kasseroller 1998; Sander et al. 2002; Tewari et al. 2008; Haase et al. 2009; Fedele and von Rautenfeld 2005). Volume measurement...
by perometry (Haase et al. 2009), the most accurate volumetric assessment of the equine limb, was too expensive for this small pilot study. The disc model is considered adequate to use in horses and works well for the area of the equine cannon (Fedele and von Rautenfeld 2005). It is not as accurate in the area below the fetlock. Precise tape measuring was challenging as numerous nodules and folds result in an uneven skin surface. Moreover, areas with fibrotic nodules, most prominently seen in horses #3 and 4, did not reduce in size uniformly. Therefore, volumetric measurements have to be interpreted in view of other changes, including better definition of the normal architecture of the distal legs as well as softening of fibrotic nodules and folds. The volume reduction was most noticeable in horses with prominent edema, such as horse #1 and 2, despite receiving fewer CDT treatments. The least reduction was measured in horse #5, which also had the least edema. Additional positive systemic effects of MLD, as earlier described by Fedele and von Rautenfeld in 2005, was evidenced by the size reduction and softening of the ventral abdominal swelling in horse #3.

Follow up information indicates that results achieved by treatments applied during this pilot study were not limited to transient improvement of the horses’ legs, but rather had long term effects. Although maintenance management by using the stockings was inconsistent or lacking, owners reported that reduction of the edema as well as fibrotic nodules and improvement in movement appeared to have been largely maintained.

In conclusion, this pilot study presents evidence that CDT offers a promising tool for management of horses affected with CPL, a condition for which there is currently no cure. Until potential underlying genetic factors of CPL can be identified to further characterize the exact pathomechanisms of CPL (Momke and Distl, 2007a and 2007b; Mittmann et al. 2009; Young et al. 2007), CDT will help in keeping affected horses in better health and hence, prolonging their lives. A more extensive study is warranted to evaluate the full potential of CDT (removed). A fully comprehensive study will include a larger number of horses, rigorous pretreatment of mite and bacterial infections, extensive initial CDT treatment including a more extensive exercise program, until no further changes are observed, and adequate administration of Phase 2 CDT treatment.

References


