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# Comparison of effects of routine topical treatments in the milking parlor on digital dermatitis lesions

**C. Jacobs,*[1] K. Orsel,* S. Mason,*† and W. Barkema***
*Department of Production Animal Health, University of Calgary, Calgary, Alberta, Canada T2N 4N1
†Farm Animal Care Associates, Calgary, Alberta, Canada T2L 0T6

## ABSTRACT

Digital dermatitis (DD), an infectious bacterial disease affecting the feet of dairy cattle, can cause lameness and decrease milk production, fertility, and animal welfare. Current DD treatment typically involves routine hoof trimming and topical antibiotics. Several nonantibiotic commercial topical products are used for controlling DD lesions; however, there is limited or no evidence regarding their effectiveness. The objectives of this study were to evaluate 2 commercially available topical applications on their ability to (1) clinically cure active DD lesions to nonactive lesions and (2) prevent recurrence of active DD lesions. Ten farms were visited weekly. In the milking parlor, the hind feet of lactating cattle were cleaned and scored (M-stage scoring system). Cattle with DD lesions at the first visit were randomly allocated to 1 of 4 treatment groups: positive control (tetracycline solution), HealMax (AgroChem Inc., Saratoga Springs, NY), HoofSol (Diamond Hoof Care Ltd., Intracare BV, Veghel, the Netherlands), and a negative control (saline). All products were applied to lesions using a spray bottle. Tetracycline, HealMax, and HoofSol had a higher probability of clinical cure for active lesions compared with saline 1 wk after the first treatment (wk 1), with 69, 52, and 79% clinical cure of active lesions, respectively, compared with 34% with saline. At wk 7, the probability of clinical cure for active lesions was 10, 33, 31, and 45% of lesions treated weekly with saline, tetracycline, HealMax, and HoofSol, respectively (no difference among treatments). The substantial clinical cure with saline highlighted the potential importance of cleaning feet. In wk 1, treatment with saline, tetracycline, HealMax, and HoofSol resulted in a probability of recurrence of active DD lesions of 9, 11, 11, and 8%, respectively, with no product being superior to saline. After 7 wk, the probability of recurrence of active lesions was 5, 7, 6, and 6% for saline, tetracycline, HealMax, and HoofSol respectively, with no difference among groups in wk 7. These results provide alternatives to antibiotics for treatment of DD lesions and highlight the potential importance of cleaning feet in the milking parlor.
**Key words:** topical treatment, intervention, control, lameness, digital dermatitis

## INTRODUCTION

Digital dermatitis (**DD**) is an infectious bacterial disease affecting the feet of cattle. The disease results in lesions that can cause lameness, production losses, poor fertility, and decreased animal welfare in dairy cattle (Holzhauer et al., 2008). It is considered endemic in dairy farms in much of the world (van Amstel et al., 1995; Rodriguez-Lainz et al., 1998; Wells et al., 1999; Holzhauer et al., 2006; van Andel et al., 2012; Solano et al., 2016), affecting up to 92% of farms in Europe and North America, with herd-level prevalence ranging from 0 to 74% (Somers et al., 2005; Holzhauer et al., 2006; Cramer et al., 2008; Solano et al., 2016). The infectious nature of DD, attributed to a complex polybacterial community consistently including multiple *Treponema* spp. (Gomez et al., 2012; Krull et al., 2014, 2016a), results in spread of lesions after an infected cow is introduced to the herd and is extremely difficult to eradicate once present (Orsel et al., 2017).

Currently, DD detection in the trimming chute is the gold standard, although more efficient detection methods have been developed for use in the milking parlor and during pen walks (Relun et al., 2011; Stokes et al., 2012; Winders et al., 2015; Jacobs et al., 2017; Solano et al., 2017a). In addition, numerous scoring systems have been developed to distinguish disease stages, with the M-stage scoring system (Berry et al., 2012; Döpfer et al., 1997) being the most common and differentiating between active and healing or chronic lesion stages.

On-farm DD control includes prevention and treatment. Preventative practices include herd-level foot bathing (Laven and Logue, 2006) and improved biosecu-

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[1]Corresponding author: jacobs.casey@gmail.com

rity (Wells et al., 1999; Oliveira et al., 2017). Individual cow treatment is typically done during routine hoof trimming, with topical products (often tetracycline or other antimicrobials; Potterton et al., 2012) applied to DD lesions on an infrequent basis. Recommendations for early detection and treatment of DD lesions have been made to improve treatment outcomes and reduce prevalence of DD (Orsel et al., 2017).

The use of tetracycline and oxytetracycline for treating DD lesions in North America is currently off label, has been associated with antibiotic residues in milk (Cramer and Johnson, 2015), and contributes to growing concerns regarding antimicrobial resistance (Tang et al., 2017). Aerosolized oxytetracycline is currently licensed for use in the United Kingdom, and oxytetracycline solution was more efficacious in treating DD compared with a negative control (Britt et al., 1996). Also, Hernandez et al. (1999) reported that oxytetracycline solution was more efficacious than 5% $CuSO_4$ solution, acidified $CuSO_4$ solution, hydrogen peroxide–peroxyacetic acid, and tap water, with a bacterial spectrum similar to tetracycline and chlortetracycline products. Various treatment regimens for tetracyclines have been tested, resulting in clinical cure rates ranging from 22 to 73% over 3 to 30 d (Nishikawa and Taguchi, 2008; Berry et al., 2010; Cutler et al., 2013). Additionally, antibiotic products remain difficult to use routinely and difficult to apply because they require animal restraint or application in the milking parlor, where antibiotics should be avoided. Consequently, nonantibiotic topical applications are available commercially and marketed for control of DD; however, few have been clinically tested for effectiveness (Shearer and Hernandez, 2000; Moore et al., 2001). Intra Hoofsol liquid (Diamond Hoof Care Ltd., Intracare BV, Veghel, the Netherlands) and HealMax (AgroChem Inc., Saratoga Spings, NY) are 2 widely used commercially available topical applications marketed for control of DD in dairy cattle. HoofSol is similar to a topical product previously studied (Intra Hoof Fit gel; Intracare BV) and is reported to be more effective at curing ulcerative (M2) lesions compared with chlortetracycline (Holzhauer et al., 2011); however, its efficacy on early lesions and preventing active DD lesions apparently has not been reported. HealMax is a glutaraldehyde-based product, and glutaraldehyde has been reported to be equally effective at killing *Treponema* bacteria at 30-s and 10-min exposure times with a minimum bactericidal concentration of 0.188% (vol/vol; Hartshorn et al., 2013). However, randomized clinical trials testing the efficacy of HealMax on DD lesions apparently have not been reported. There is a need to determine effective treatment strategies to routinely identify and promptly treat DD lesions to improve management of DD, decrease prevalence of DD on farms, and improve animal welfare and production. Because early identification and treatment are commonly suggested, the efficacy of topical products to treat DD lesions in early DD lesion stages should be included as opposed to treatment of only ulcerative lesion stages. Also, producers may not differentiate M-stages and may simply treat any visual presentation of DD. Therefore, the objective of this study was to evaluate an 8-wk routine treatment program of HoofSol and HealMax for their ability to (1) transition active DD lesions to nonactive lesions ("clinical cure") and (2) prevent recurrence of active DD lesions compared with positive (tetracycline solution) and negative (saline) controls.

## MATERIALS AND METHODS

### Farm and Cow Selection

A randomized blinded controlled intervention trial was conducted on 10 dairy farms in Alberta, Canada, to evaluate routine use of various topical applications on DD lesions in the milking parlor. Participating farms had (1) a lactating herd prevalence (all stages) of at least 25% as determined by Jacobs et al. (2017) to achieve an average herd-level prevalence of $\geq$40% (per the sample size calculation) and (2) cows being milked in a milking parlor, allowing for DD lesion assessment and topical treatment application. Data were collected between January 25 and March 29, 2016. All methods were approved by the University of Calgary Veterinary Sciences Animal Care Committee (AC15-0099).

### Sample Size Justification

To detect a 20% difference in proportion of active lesions (M1, M2, M4.1) that transitioned to nonactive stages (i.e., clinical cure) in treatment groups compared with the negative control (assuming active treatment will result in 42.9% of treated lesions healing in 1 wk (Cutler et al., 2013), with an $\alpha$ of 0.013 (Bonferroni correction for 4 comparisons with an $\alpha$ of 0.05 results) and 80% power, 140 active lesions would be required per treatment group (560 total). Using an average herd size of 200 lactating cows and an average active baseline herd-level DD prevalence of 20%, 40 cows with lesions needed to be recruited per farm in the first week to be assigned weekly to treatment groups. Ten farms would contribute approximately 640 cows with lesions (40 cows with lesions per farm in wk 1 $\times$ 10 farms = 400) in the first week to be identified and treated according to protocol. With an estimated 2% incidence