Development and Evaluation of Teat Coverage Persistency for New Prototype Dry Period Persistent Barrier Teat Dips

A.S. Leaflet R2716

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Summary and Implications

Mastitis research has shown that 40-50% of intramammary infections (IMI) are contracted during the dry or non-lactating period with the greatest percentages of these occurring during the first and last two weeks of the dry period. The ability to develop and apply external persistent barrier teat dip products (like a liquid bandage) that can persist for these 1 week periods could decrease IMI, thus improving animal health and performance, and product quality and safety. The specific aim of this study was to evaluate teat dip characteristics (teat health and adherence times) of novel prototype dry cow barrier teat dip products compared to a commercial product. Dipping with the new prototype dry cow persistent barrier teat dips compared to a commercial dip resulted in similar excellent teat end and skin health. Initially, many of the prototypes has shortened persistency on teats compared to the commercial product but results from later trials showed some prototype products to have equal persistency to the commercial product.

Introduction

Mastitis research has shown that 40-50% of intramammary infections (IMI) are contracted during the dry or non-lactating period with the greatest percentages of these occurring during the first and last two weeks of the dry period. At these times, the mammary gland is in a transitional state. Immunological factors are preoccupied or suppressed, milk is not being flushed from the gland, and increased mammary pressure distends the teat, thus allowing for easier bacterial penetration through the streak canal. Both external persistent sealant (2-5 day adherence) dips and internal teat sealants have been developed and shown to decrease IMI rates, especially environmental mastitis, in dry cows/ springing heifers during the early dry and late prepartum periods when used properly. The ability to develop and apply external persistent barrier teat dip products (like a liquid bandage) that can persist for these 1 week periods could decrease IMI, thus improving animal health and performance, and product quality and safety. The specific aim of these studies (5 trials) were to develop (in conjunction with DeLaval, Inc.) and evaluate teat dip characteristics (effects on teat health and adherence times) of novel prototype dry cow barrier teat dip products compared to a commercial product.

Materials and Methods

Dips used: 1-3 different prototype dips were compared to a commercially available dry cow barrier dip (T- Hexx Dry, Hydromer, Inc. (Blue)) using a randomized quarter within cow design. When 4 dips were used in a trial, the 4 dips were randomized across quarters within cow thus minimizing cow effect on adherence variability (largest variable). When 2 dips were used, dips were applied randomly to different udder halves (right or left teats).

Cows: All protocols were approved by the ISU Committee on Animal Care. Cows were housed in a free stall barn with sand bedding and headlocks on the south side of the ISU dry cow barn. Cows were fed and locked up for initial teat health analysis and dipping.

Animal ID and teat health evaluation Animals in lockups were visually identified by eartag. All teats of all animals were cleaned and dried with terry cloth towels. If teats were visibly dirty, teats were pre-dipped first with a .25% iodine predip and then dried with the towel. Individual teat ends and teat skin for every animal were evaluated by one scorer. All teats showed excellent teat health pre and post dip removal so data is not shown (no differences).

Teat dipping: Dips were dispensed into dixie cups for dipping and refilled as needed. Teats were dipped so that coverage was the whole teat. Observations of film or dip thickness and stringing of dip were recorded.

Teat dip persistency evaluation: Teat dip persistency or coverage of teats (especially teat ends) was conducted every 12 -24 hrs. Teat dip coverage was score using a 0-4 scale: (4= complete teat adherence similar to originally dipped; 3 = dip starting to peel but on ¾ of teat; 2 = 50% of teat covered; 1 = teat end only covered; and 1 = dip completely off. Dip shearing, flaking, or tearing were also recorded.

Statistical analysis: Logistic regression was used to test the differences in proportion of cow teat ends that were protected (adherence score of 4, 3, 2 or 1) using the statistical package MLwiN 2.22 (Center for Multilevel Modelling, University of Bristol). Treatments were compared relative to the control product. Statistical significance was set at 0.05.

Results and Discussion

Teat end and teat skin health: Prior to dipping, most teats had excellent teat skin and ends since these were mid dry cows and heifers (no milking machine pressures) and season was summer (minimal temperature issues).

➢ There were no differences among dips with regards to teat skin and teat end health. Some teats showed improvements in teat skin and teat end health (similar across dips) and no adverse effects of dips were seen.

Teat dip persistency and coverage:

Trial 1: (Table 1) Four external teat sealants were applied to 11 cows and 5 heifers for assessment of adherence to teat skin/teat end over a period of 5d. Only data of adherence to cow teats were analyzed because heifers had smaller teats and quickly lost the product after application. On average, the control product and treatments 430-9-1 and 430-9-2 had >70% teat ends protected 3d after application. Compared to the control product (430-9-3), treatments 430-9-1 and 430-9-2 had similar adherence after 3d. After 4d, only 430-9-2 had similar adherence to the control product, where >25% teat ends were protected. Because of low numbers of protected teats, no statistical conclusion could be made for adherence of products on teats after 5d. High temperature and humidity played a significant role in adherence of products on teats.

Trial 2 (Table 2): Four external teat sealants were applied to 27 animals for assessment of adherence to teat skin/teat end over a period of 5d. On average, >90% teat ends were protected after 24h of dipping. After 48h this had decreased to 67%, 50% after 72h, 30% after 96h and 15% after120h. Shredding of film was also recorded and showed that its presence indicated a total disruption of the membrane the following day. Although shredding rate was similar between products, 64% teats did not show signs of shredding during the 5d test period. No statistical differences existed between the test products and control product on the parameters tested.

Trial 3 (Table 3): Four external teat sealants (all prototypes) were applied to 18 animals for assessment of adherence to teat skin/teat end over a period of 5d. All treatments protected 100% teat ends after the first day. Afterwards, the rate of protection differed between groups.

Based on the results of this study, 430-65-1 persists more on teats compared to 430-65-2 and 430-65-4 ($P<0.05$). There are also numerical differences between 430-65-1 and 430-65-3 favoring the reference formula. It can be concluded that from the 4 formulas tested, 430-65-1 persists more on teats, displaying good film consistency and firmness on dry cow teats. This formula protected 72% teats (after 3d), 50% teats (after 4d), and 33% (after 5d).

Trial 4 (Table 4): Two external teat sealants (prototypes) were applied to 14 animals for assessment of adherence to teat skin/teat end over a period of 5d. Protection of teats did not differ between both products at any day after initial dipping (days 1 to 5 post dipping). After 3d, average teat end protection was 54% for the experimental formula and 36% for the control product. After 5d, teat protection was below 30% for both products. It was concluded that no difference existed between both products in providing protection to teat ends over a 5d period.

Trial 5: Trial 5 encompassed 4 dips (3 prototype and 1 commercial) and 24 cows. Data is currently being analyzed.

Overall Summary

Dipping with the new prototype dry cow persistent barrier teat dips compared to a commercial dip resulted in similar excellent teat end and skin health. Initially, many of the prototypes has shortened persistency on teats compared to the commercial product but results from later trials showed some prototype products to have equal persistency to the commercial product.

Table 1. Number of teat ends protected by external teat sealants after 3, 4 and 5d (trial 1).

Treatment	Total quarters (n)	Quarters with adherence scores 4-1		
		After 72h	After 96h	After 120h**
430-9-1	11	8	1*	0
430-9-2	11	7	3	1
430-9-3	11	9	7	3
430-9-4	11	3*	2*	1

* treatments different to 430-9-3 ($P<0.05$)
** not enough numbers to conduct statistical analysis

Table 2. Number of teat ends protected by external teat sealants after dipping (trial 2).

Treatment	Initial	After 24h		After 48h		After 72h		After 96h		After 120h	
	n	n	P value	n	P value	n	P value	n	P value	n	P value
430-9-2	27	26	Ref	20	Ref	15	Ref	7	Ref	5	Ref
430-32-1	27	24	0.32	19	0.76	15	1.00	8	0.76	2	0.24
430-32-2	27	24	0.32	18	0.55	12	0.42	8	0.76	4	0.72
430-32-3	27	24	0.32	15	0.16	12	0.42	9	0.55	5	1.00
Grand Total	108	98		72		54		32		16	
Average (%)		91		67		50		30		15	

Table 3. Number of teat ends protected by external teat sealants after dipping (trial 3).

Treatment	After 24h		After 48h		After 72h		After 96h		After 120h	
	n	P value	n	P value	n	P value	n	P value	n	P value
430-65-1	18	Ref	16	Ref	13	Ref	9	Ref	6	Ref
430-65-2	18*	-	15	0.63	7	0.05	3	0.04	0*	-
430-65-3	18*	-	15	0.63	10	0.30	6	0.31	2	0.12
430-65-4	18*	-	14	0.38	7	0.05	3	0.04	2	0.12
Grand Total	72		60		37		21		10	

* Not enough numbers to conduct statistical analyses

Table 4. Number of teat ends protected by external teat sealants after dipping (trial 4).

Treatment	Initial	After 24h		After 48h		After 72h		After 96h		After 120h	
	n	n	P value	n	P value	n	P value	n	P value	n	P value
430-83-1	28	21	Ref	17	Ref	15	Ref	10	Ref	6	Ref
430-83-2	28	25	0.18	13	0.29	10	0.18	8	0.57	8	0.54
Grand Total	56	46		30		25		18		14	